



ALLEGHANY COUNTY

2007 COMMUNITY HEALTH ASSESSMENT

Volume Two: Environmental Data

**Final Technical Report
October, 2007**



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 Alleghany County. It is intended to complement Volume I of the Alleghany County Community Health Assessment, *Demographic, Socioeconomic and Health Data*, by describing the environmental context in which the people of Alleghany 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 broadly based on the Center for Disease Control (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 Alleghany County, using primarily data from the public domain supplemented by local data where appropriate and available. 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 identifies community exposure to lead, pesticides, 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 evaluated 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; as the population continues to grow, the demand for clean water rises every year.

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).

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 Alleghany 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, Alleghany County ranked among the 30% 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 *number* of water bodies in Alleghany County that are actually impaired are compared to the rest of the nation, the County falls in the 40th percentile of dirtiest/worst counties in the nation (3). A water body 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 water body 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 1998 list of impaired waters, which was compiled on the basis of state data from 1997-1998, three percent of the surface waters in Alleghany County had reported water problems (3). For comparison, the North Carolina county with the highest percentage (80-90%) of impaired water bodies in that report was Richmond County, which was also in the top percentile of counties, ranked nationwide, with threatened and impaired water bodies.

The following table describes the 1998 Clean Water Act status of Alleghany County as well as the leading pollutants and stressors of surface waters. Note that there are possible inconsistencies in data on impaired water bodies and the percentage of water bodies assessed. For further explanation, see http://www.scorecard.org/env-releases/def/water_inconsistency.htm.

Table 1. Alleghany County Clean Water Act Status, 1998

Surface water type	Surface Waters with Reported Problems		Leading Pollutants and Stressors (% Affected)				
	No.	%	Sediments	Impaired Biological Community	Pathogens	Ammonia	Mercury
Rivers, Streams, Creeks	33	3%	21%	18%	15%	12%	3%
Lakes, Reservoirs, Ponds	0	-	-	-	-	-	-

Source: Environmental Defense Scorecard, Pollution Locator, Water. Available at http://www.scorecard.org/env-releases/water/cwa-county.tcl?fips_county_code=37005#report. (Accessed July 2007).

A complete list of the 33 water bodies with reported problems can be found at http://www.scorecard.org/env-releases/water/cwa-waterbodies-in-region.tcl?fips_county_code=37005. The following section describes the pollutants and stressors as shown in Table 1 (5).

Sedimentation 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 (6).

Impaired Biological Communities are aquatic ecosystems that provide habitat for a variety of species but have been adversely affected by human activities (7).

Pathogens, such as waterborne bacteria, viruses and protozoa 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 ().

Ammonia is an inorganic form of nitrogen, which in conditions of increased temperature and pH, can become de-ionized and therefore be toxic to aquatic life ().

Mercury is “a naturally occurring element that can be toxic when consumed by animals and humans. Sources of mercury include weathering of the earth's crust, the burning of garbage and fuels, and industrial emissions” ().

The following table indicates the leading sources of water quality impairment for the rivers, streams, and creeks in Alleghany County.

Table 2. Alleghany County Leading Sources of Water Quality Impairment for Rivers, Streams, and Creeks, 1998

Source of Impairment (% Affected)							
Non-point	Municipal Point	Agriculture	Not Reported	Urban Runoff/ Storm Sewers	Resource Extraction	Silviculture	Unknown
58%	21%	18%	12%	12%	3%	3%	3%

Source: Environmental Defense Scorecard, Pollution Locator, Water. Available at http://www.scorecard.org/env-releases/water/cwa-county.tcl?fips_county_code=37005#report. (Accessed February 2007).

In Alleghany County, the primary sources of water quality problems for rivers, streams, and creeks come from non-point sources, which affected 58% of the impaired water bodies in the County. Municipal sources account for 21% of the impairment, 12% of sources were not reported, 12% of sources were due to urban runoff/storm sewers, resource extraction accounted for 3%, as did silviculture. Another 3% of sources were unknown (6). The following section describes these impairments.

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 ().

Municipal point source pollution is discharge 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 ().

Agriculture can cause pollutants that affect water quality. Agricultural activities that can contribute to pollution include confined animal facilities, grazing, plowing, pesticide spraying, irrigation, fertilizing, planting, and harvesting. These activities can result in sediment,

nutrients, pathogens, pesticides, and salts, as well as damage habitat and stream channels ().

Urban runoff/storm sewers can erode streambanks, damage streamside vegetation, and widen stream channels leading to lower water depths during non-storm periods, higher than normal water levels during wet weather periods, increased sediment loads, and higher water temperatures. Additionally, pollutants from urbanization can be transported by runoff including oil, grease, and toxic chemicals from automobiles; nutrients and pesticides from turf management and gardening; viruses and bacteria from failing septic systems; road salts; and heavy metals. Aquatic life cannot survive in urban streams severely impacted by urban runoff ().

Resources extraction refers to industrial activities in the environment that potentially disturb large amounts of material and land area. Adverse effects can include acid mine drainage, erosion and sedimentation, chemical releases, hydrologic changes, and drawdown – the reduction of water available for recharging wetlands and surface water ().

Silviculture refers to forestry activities that can impair water quality through the removal of streamside vegetation, road construction and use (the primary source of non point pollution), timber harvesting, and mechanical preparation for the planting of trees. Harvesting trees in the area beside a stream can affect water quality because it can reduce the shading that regulates water temperature. Also, it can affect the erosion of streambanks because vegetation stabilizes the soil. These changes can harm aquatic life by limiting sources of food, shade, and shelter ().

Watersheds

The majority of Alleghany County lies in the New River Basin, but also contains a portion of the Yadkin Pee-Dee River Basin (7, 8, 9).

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.

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. This 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 (10). The EPA uses nine indicators to profile the vulnerability of aquatic resources to future degradation and classify them into one of seven categories (11):

1. Better Water Quality - Low Vulnerability:

Designated uses are largely met and other indicators of watershed condition show few problems. Pollutants or other stressors are low, so there is a lower potential for future declines in aquatic health. Actions to prevent declines in aquatic conditions in these watersheds are appropriate, but at a lower priority than in watersheds with higher vulnerability.

2. Better Water Quality - High Vulnerability:

Designated uses are largely met and other indicators of watershed condition show few problems. Significant pollution and other stressors exist, so there is a higher vulnerability to declines in aquatic health. These watersheds have the greatest need for actions to protect quality and prevent decline.

3. Less Serious Water Quality Problems - Low Vulnerability:

Watersheds with aquatic conditions below water quality goals and with problems revealed by other indicators. Pollutants or other stressors are low, so there is a lower potential for future declines in aquatic health. Actions to prevent declines in aquatic conditions in these watersheds are appropriate, but at a lower priority than in watersheds with higher vulnerability.

4. Less Serious Water Quality Problems - High Vulnerability:

Watersheds with aquatic conditions below water quality goals and with problems revealed by other indicators. Significant pollution and other stressors exist, so there is a higher vulnerability to declines in aquatic health. These watersheds have the greatest need for actions to protect quality and prevent decline.

5. More Serious Water Quality Problems - Low Vulnerability:

Watersheds with aquatic conditions well below water quality goals and with serious problems exposed by other indicators. Pollutants or other stressors are low, so there is a lower potential for future declines in aquatic health. Actions to prevent declines in aquatic conditions in these watersheds are appropriate, but at a lower priority than in watersheds with higher vulnerability.

6. More Serious Water Quality Problems - High Vulnerability:

Watersheds with aquatic conditions well below water quality goals and with serious problems exposed by other indicators. Significant pollution and other stressors exist, so there is a higher vulnerability to declines in aquatic health. These watersheds have the greatest need for actions to protect quality and prevent decline.

7. Insufficient Data:

There are insufficient data to accurately characterize the watersheds.

The major watersheds of Alleghany County is the Upper New, but it also contains a small portion of the Upper Yadkin watershed (12). Both watersheds are characterized by “better” water quality with “low” vulnerability (13).

The EPA has classified one of the watersheds in Alleghany County as highly vulnerable to agricultural run-off, population change, and hydrologic modification, and as having aquatic/wetland species at risk. 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.

Growth of the human population can impact watersheds through increased pollution and land use changes which include construction, loss of wetlands, and increased sewage flows. Aquatic/wetland species at risk indicates that in a given watershed, there are aquatic or wetland species that are classified by the Heritage Network as critically imperiled, or are listed as "threatened" or "endangered" under the federal Endangered Species Act. This indicator suggests that the watershed is highly vulnerable to water quality or habitat degradation and therefore jeopardizes the survival of susceptible aquatic or wetland species; it does not necessarily indicate poor watershed conditions but rather that there is not the exceptionally high quality habitat necessary to sustain these species (14).

Water Quality in the New River Basin

The following section details the water quality of the New River Basin as it pertains to Alleghany 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) (15). The most recent assessment of the New River Basin was completed August 2004 (16).

The headwaters of the New River Basin are in Watauga County, North Carolina. The river flows northeasterly towards Radford, Virginia, and from there it continues northwesterly to West Virginia where it flows into the confluence of the Gauley River to form the Kanawha River which is a tributary to the Ohio River. The basin is 115 miles in length from Blowing Rock, NC to Bluestone Dam near Hinton, WV (17). For assessment and monitoring purposes, the river basin is divided into three subbasins for North Carolina; Alleghany County contains a portion of subbasins 01 and 03 ().

Subbasin 01 contains portions of three ecoregions: the New River Plateau, Amphibolite Mountains, and Southern Crystalline Ridges and Mountains. The largest watershed in the subbasin is the South Fork New River, which receives runoff from the towns of Boone, Blowing Rock, and Jefferson. Land is primarily urban and suburban near Boone and Blowing Rock, but elsewhere is primarily forested, pasture, and managed herbaceous (Christmas tree farming). There are nine permitted dischargers, three of which exceed 0.1 MGD (million gallons per day): Boone wastewater treatment plant (WWTP), Blowing Rock wastewater treatment plant, and Jefferson wastewater treatment plant ().

Subbasin 03 is in the New River Plateau ecoregion and contains a portion of the New River watershed and the entire Little River watershed. Elevations in the subbasin are between 2500-3500 feet land use is primarily pastureland and forest, although it also includes woodland/forest, orchards, cropland, livestock and dairy farms, and Christmas tree

production. The Town of Sparta is the largest urban area and the town's wastewater treatment plant is the largest discharger in the subbasin ().

Water Quality in the Yadkin-Pee Dee River Basin

The following section details the water quality of the Yadkin-Pee Dee River Basin as it pertains to Alleghany 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) (18). The most recent assessment of the Yadkin-Pee Dee River Basin was completed in 2007 (19).

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 Pee-Dee River Basin is the second largest basin in North Carolina. For assessment and monitoring purposes the entire river basin is divided into 17 subbasins; Alleghany County contains portions of Subbasins 01 and 02.

Subbasin 01 contains the mountainous headwaters of the Yadkin River that are primarily located within the Southern Crystalline Ridges and Mountain ecoregion. The subbasin also includes portions of the Eastern Blue Ridge Foothills ecoregion along its southern border. Major tributaries include Buffalo, Elk and Stony Creeks, North and South Prong Lewis Forks, Reddies River, Mullberry Creek, and Roaring River. The W. Kerr Scott Reservoir is also in the subbasin. In this area, the stream gradients are high: mountain streams are mostly classified as trout streams and considered mountain cold water, while foothills are considered cool water systems. Land use is predominantly forest. Major dischargers include the cities of Wilkesboro and North Wilkesboro, both of which have wastewater treatment plants discharging into the Yadkin River (4.9 MGD and 2.0 MGD respectively), and the Louisiana Pacific Corporation ABTCO plant that discharges 1.0 MGD ().

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) ().

Impaired Water Bodies in the Alleghany County

According to section 303(d) of the CWA, there are no water bodies in Alleghany County that have been classified as impaired.

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 3 shows the bioclassifications for the river subbasins that pertain to Alleghany County. The majority of stations were rated Good or Excellent. There were no bioclassification stations in the Yadkin-Pee Dee River Basin, or in subbasin 01 of the New River Basin that apply to Alleghany County.

Table 3. Bioclassification of Water Bodies located in Alleghany County

Subbasin	Water Body	Location	1998 Status	2003 Status
	New River	SR 1345	Good	Excellent
	Elk Creek	SR 1344	Good	Good
	Pine Swamp Creek	SR 1128	Good	Good-Fair
	Little River	SR 1128	Good	Good
New 03	Little River	SR 1424	Excellent	Excellent
	Little River	NC 18	Excellent	Excellent
	Bledsoe Creek	SR 1172	Good-Fair	Good
	Brush Creek	SR 1422	Good	Excellent
	Laurel Brook	SR 1105	Good	Good

Source: NC Department of Environment and Natural Resources. Division of Water Quality. Basinwide Assessment Report New River Basin, 2004. <http://www.esb.enr.state.nc.us/bar.html>. (Accessed January 2007).

Ambient Monitoring System Data

There are 39 DWQ Ambient Monitoring System (AMS) stations in the Yadkin-Pee Dee River Basin, none of which are in Alleghany County and there are six DWQ AMS stations in the New River Basin, two of which are in Alleghany County (.). Table 4 provides information on each of these stations.

Table 4. DWQ Ambient Monitoring System stations in Alleghany County

Subbasin	Station #	Location
New 03	K7900000	New River at SR 1345 At Amelia
	K9700000	Little River at SR 1433 Hooker Road near Edwards Crossroads

Source: NC Department of Environment and Natural Resources. Division of Water Quality. Basinwide Assessment Report New River Basin, 2004. <http://www.esb.enr.state.nc.us/bar.html>. (Accessed January 2007).
Source: NC Department of Environment and Natural Resources. Division of Water Quality. Environmental Sciences Branch. Monitoring. Network of Stations. NC Division of Water Quality Ambient Monitoring Network. Available at <http://h2o.enr.state.nc.us/esb/stations/ams.htm>. (Accessed February 2007).

The following data describe the results of AMS monitoring for the five year period from 1998 through 2003.

Water Chemistry. According to data from the AMS, there were no significant or actionable exceedances of water quality standards for dissolved oxygen any the fixed monitoring sites in the New River Basin. 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.

Similarly, there were no significant exceedances of pH at the two monitoring sites in Alleghany County. However two AMS stations elsewhere in the New River Basin had more than 10 percent of measurements outside the pH value limits set by North Carolina Administrative Code. Low pH values are indicative of waters rich in organic matter whereas high values are found during algal blooms.

Turbidity data values typically vary according to the intensity of rainfall events. No stations in Alleghany County had more than 10 percent of observations greater than the standard of 50 NTU (National Turbidity Units). Although some values throughout the river basin showed exceedances of 50 NTU, these values were associated with intense or sustained rainfall events.

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 are not a common problem in the New River Basin. Only one station had more than 10% of observations greater than the standard level for lead; this station was not in Alleghany County.

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 water bodies 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.

Four of the AMS sites in the New River Basin, including the two in Alleghany County, had more than 10% of fecal coliform counts exceeding the plate count reference standard of 400 colonies/100 ml.

Chlorophyll a. Chlorophyll a is used to estimate the amount of phytoplankton in water. The water quality standard is 40 µg/L and values greater than this indicate large volumes of phytoplankton. This parameter was not reported in the most recent assessment of New River Basin.

Nutrients. The introduction of nutrients, especially nitrogen and phosphorus, into water bodies 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. Both sites in Alleghany County showed more than 10% of concentrations greater the standard for nitrite+nitrate nitrogen.

Fish Kills

There were no fish kill events reported in Alleghany County between 1997 and 2006 (20).

Fish Consumption Advisories

The Epidemiology Section of the NC Division of Public Health maintains an Internet website listing current fish consumption advice and advisories across the State (21). As of March 2007 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 and fish low in mercury no more than four meals per week. The fish with high mercury levels are primarily ocean species, and include: almaco jack, banded rudderfish, canned white tuna (albacore tuna), cobia, crevalle jack, greater amberjack, south Atlantic grouper (gag, scamp, red, and snowy), king mackerel, ladyfish, little tunny, marlin, orange roughy, shark, Spanish mackerel, swordfish, tilefish, and tuna (fresh or frozen). 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 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 are in Alleghany County.

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. From 2004-2006, the State Laboratory conducted microbiological analyses for 3 water samples from Alleghany County (Table 5). Of these, none showed the presence of bacteria according to analysis for "total coliforms". Because none of the samples positive for total coliforms, *E. coli* was not tested (22). Most well water tests conducted in Alleghany County are analyzed in a local laboratory, data from which were not available by press time.

Table 5. Alleghany County Private Wells Testing Positive for Total Coliforms or *E. coli*, 2004-2006

Year	No. Samples	No. Positive Total Coliforms	% Positive Total Coliforms	No. Positive <i>E.coli</i>	% Positive <i>E. coli</i>
2004	2	0	0%	0	0%
2005	1	0	0%	0	0%
2006	0	0	0%	0	0%
Total	3	0	0%	0	0%

NB: *E.coli* is only tested in samples that also test positive for total coliforms. However, the % positive *E. coli* indicated above uses the number of total samples as its denominator, not the number of positive total coliforms.

Source: NC State Laboratory of Public Health. Environmental Sciences. Microbiology. Sample Test Results. Available at <http://slph.state.nc.us/EnvironmentalSciences/Microbiology/frmMainSearch.aspx>. (Accessed January 2007).

Groundwater Incidents

The NC Division of Water Quality Incident Management Office keeps track of leaks and spills of chemicals that present risks to health. There were no such incidents reported in Alleghany County from 2001-2006.

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 (23). Table 6 lists the current NAAQS.

Table 6. National Ambient Air Quality Standards

Pollutant	Primary Standard	Averaging Times	Notes
Carbon monoxide (CO)	9 ppm (10 mg/m ³)	8-hour	Not to be exceeded > 1/year
	35 ppm (40 mg/m ³)	1-hour	Not to be exceeded > 1/year
Lead	1.5 µg/m ³	Quarterly average	--
Nitrogen dioxide	0.053 ppm (100 µg/m ³)	Annual mean	--
Particulate matter (PM ₁₀)	150 µg/m ³	24-hour	Not to be exceeded > 1/year on average over 3 years
	15.0 µg/m ³	Annual mean	To attain this standard, the 3-year average of the weighted annual mean PM _{2.5} concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m ³
Particulate matter (PM _{2.5})	35 µg/m ³	24-hour	To attain this standard, the 3-year average of the 98 th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m ³
	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
Ozone (O ₃)	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)
	0.03 ppm	Annual mean	--
Sulfur Oxides (SO _x)	0.14 ppm	24-hour	Not to be exceeded > 1/year

Source: Environmental Protection Agency. Air & Radiation. National Ambient Air Quality Standards (NAAQS). <http://www.epa.gov/air/criteria.html>. (Accessed January 2007).

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_x) 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 (O₃), 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_x) react to form O₃ when stimulated by ultraviolet radiation and temperature, so peak O₃ levels typically occur during the warmer times of the day and year. 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 (SO₂) 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 (24).

Table 7. Health and Environmental Effects of Criteria Air Pollutants

Pollutant	Effect
CO	Reduces delivery of oxygen to the body's organs and tissues
Pb	Affects nervous, reproductive, digestive, cardiovascular systems and the kidney
NO _x	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 ₃	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 ₂	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>. (Accessed January 2007).

Annual CAP Maxima

Annual high levels of criteria air pollutants are not available specifically for Alleghany County, but are available for North Carolina as a whole (25). 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; all other annual maxima were below the NAAQS standards (Table 8).

Table 8. North Carolina Annual High Levels of Criteria Air Pollutant Emissions, 2005

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	0.12ppm	0.146ppm
8-hour average max	0.08ppm	0.111ppm
PM-25		
24-hour average max	65µg/m ³	70µg/m ³
PM-10		
24-hour average max	150ug/m ³	69µg/m ³
Sulfur Dioxide		
3-hour average max	0.5ppm	0.106ppm
24-hour average max	0.14ppm	0.030ppm

Source: Environmental Protection Agency. Air & Radiation. Air Data. <http://www.epa.gov/air/data/geosel.html>. (Accessed January 2007).

North Carolina ranks 10th in the nation for CO emissions; 14th for NO_x emissions; 13th for PM-2.5 emissions; 13th for SO₂ emissions; and 8th for volatile organic compound emissions. Alleghany County does not rank in the top 25 North Carolina counties for tons of emissions of any of the six criteria air pollutants (26); it is listed in the 40th percentile of cleanest/best counties in the US for sulfur dioxide emissions, the 20th percentile of cleanest/best counties in the US for carbon monoxide emissions, and the 20th percentile for sulfur dioxide emissions. Other criteria air pollutants (nitrogen oxides and particulate matter) are in the 10th percentile of cleanest/best counties (27).

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 was formerly 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 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 (28). The AQI levels are defined in Table 9.

Table 9. 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> (Accessed January 2007).

According to the EPA, there is no AQI monitoring site in Alleghany County and so county-specific AQI data are not available (29). Non-AQI air pollution data for Alleghany 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 10 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 10. Alleghany County Criteria Air Pollutant Emissions, in Tons, 1999

Source Category	CO	NO _x	PM -2.5	PM-10	SO ₂	VOC	TOTAL
Mobile Sources	1,930	434	72	242	45	267	2,990
Area Sources	1,599	28	265	611	163	485	3,151
Point Sources	1	2	0	0	2	6	11
All Sources	3,530	464	337	853	210	758	6,152

Source: Environmental Defense. Scorecard. Pollution Locator. Smog and Particulates. Alleghany County Report. Available at: http://www.scorecard.org/env-releases/cap/county.tcl?fips_county_code=37005. (Accessed January 2007).

Area sources are defined as sources that emit less than 10 tons per year of a criterion 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, and residential and commercial buildings (heating and cooling units, fireplaces). Waste disposal in the form of open burning, landfills and wastewater treatment also are significant area sources (). In Allegheny County, area sources account for 51% of all criteria air pollution and produce more small particulate matter (79%), large particulate matter (72%), and volatile organic compounds (64%) than any other sources. Nationally, area sources account for only 21.6% of criteria air pollutants, and are not the source for the majority of any of these pollutants. County percentages are calculated from Table 10, for example, the 1,599 tons of CO released from area sources makes up 45% of the total 3,530. National percentages can be calculated similarly from information found at <http://www.scorecard.org/env-releases/cap/us.tcl> (, 30).

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 (31). Mobile sources in Allegheny County produce more carbon monoxide (55%) and nitrogen oxides (94%) than any other source. Nationally, carbon monoxide (77.1%), nitrogen oxides (55.5%), and large particulate matter (40.3%) mostly come from mobile sources. Mobile sources are the second largest source of criteria air pollutants in this County (49% of the total tonnage) and the largest source in the country (60.2%).

Point sources are those facilities that emit 10 tons per 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 (). In Allegheny County point sources are not a major contributor to any of the criteria air pollutants (<0.2% of the total), while nationally point sources account for 18.1% of the total pollutants.

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 fifty-nine times the tons of air pollutants generated in Allegheny County (32).

EPA Air Quality Non-Attainment Areas

As of December 2006, 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 (33). 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 (34). Allegheny County is not one of these non-attainment counties.

Additionally, the EPA designated three North Carolina counties as “non-attainment” regarding small particulate matter. The State has successfully worked to improve particle pollution through legislative action via the 2002 Clean Smokestacks Act which targets coal-fired power plants to reduce particle forming emissions (35). Allegheny County is not on the current list of non-attainment counties.

The EPA has not designated any North Carolina counties as “non-attainment” for carbon monoxide, nitrogen dioxide, ozone (1 hour), sulfur dioxide, large particulate matter, or lead ().

Vehicle Emission Inspection Mandates

As of January 1, 2006 48 of the 100 North Carolina counties have mandatory vehicle emission testing; Alleghany is not among them. Most of the counties under the mandate are in major population centers or along the major Interstate Highway corridors spanning the State (36).

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 (37). Table 11 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 Alleghany County is not available.

Table 11. Annual Vehicle Miles Traveled (in millions of miles), 2004

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

Source: Federal Highway Administration. Highway Statistics 2004. Selected Measures for Identifying Peer States. Available at www.fhwa.dot.gov/policy/ohim/hs04/html/ps1.htm. (Accessed January 2007).

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 (38).

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 (39), the number of vehicles in the US powered by alternative fuels has increased every year between 2002 and 2004 (Table 12). Given the recent influx of hybrid vehicles on the automotive market, it would be expected that future counts of alternative fueled vehicles would be much higher than these figures.

Table 12. Number of Vehicles in the US Powered by Alternative Fuels, 2002-2004

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
Total	471,098	510,805	547,9094

Key:* 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. Available at <http://www.census.gov>. (Accessed January 2007).

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 (40).

Alleghany County is served by Alleghany In Motion, a department of the County government. It is located in Sparta and provides transportation service by reservation for the general public on a fee basis (, 41).

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, as well as 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 (42). 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 (43).

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 (44).

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, Alleghany County ranked 76th in terms of an individual's added cancer risk. The estimated added cancer risk for the Alleghany County population is 260, that is, it is 260 times the goal set by the Clean Air Act (45).

The vast majority of the cancer risks (89%) in Alleghany 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 (46). Diesel emissions are a recognized carcinogen, and *suspected* to be a cardiovascular or blood toxicant, and a respiratory toxicant (47).

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 ().

According to data from Environmental Defense, Alleghany County is ranked 85th for cumulative hazard index out of all North Carolina counties with a score of 0.96, which is below the Clean Air Act goal of 1.0. Mecklenburg County, which is ranked as the county with the highest risks of any kind, has a cumulative hazard index of 3.5 ().

The sources of the pollutants that contribute to non-cancer health risks are not as easy to pinpoint as those leading to cancer risks, and they vary much more from county to county. However the most significant non-cancer hazardous air pollutant in Alleghany County is acrolein (). 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 (48). In Alleghany County, area sources contribute 61% to the cumulative hazard index while mobile sources contribute 32% to the CHI ().

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 (49).

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 (50).

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 statewide attributable to these causes (51).

According to the NC State Center for Health Statistics, in 2005 there were 49 deaths statewide due to CO poisoning, 14 of which were unintentional. No deaths due to CO poisoning occurred in Alleghany County in 2005 (52).

Radon

Radon is a naturally occurring, invisible, odorless gas that comes from soil, rock and water. It is a radioactive decay product of radium, which is in turn a decay product of uranium; both radium and uranium are common elements in soil. Radon usually is harmlessly dispersed in outdoor air, but when trapped in buildings it can be harmful. Most indoor radon enters a

home from the soil or rock beneath it, in the same way air and other soil gases enter: through cracks in the foundation, floors or walls, hollow-block walls, and openings around floor drains, heating and cooling ductwork, pipes, and sump pumps (53).

Radon may also be dissolved in water as it flows over radium rich rock formations. Dissolved radon can be a significant health hazard, although to a lesser extent than radon in indoor air. Homes supplied with drinking water from private wells or from community water systems that use wells as water sources generally have a greater risk of exposure to radon in water than homes receiving drinking water from municipal water treatment systems. This is because well water comes from ground water, which has much higher levels of radon than surface waters. Municipal water tends to come from surface water sources which are naturally lower in radon, and the municipal water treatment process itself tends to reduce radon levels even further (54).

Trace amounts of uranium are sometimes incorporated into construction materials such as concrete, brick, granite and drywall. Although these materials have the potential to produce radon, they are rarely the main cause of elevated radon levels in buildings ().

Elevated levels of radon have been found in many counties in North Carolina, but the highest levels have been detected primarily in the upper Piedmont and mountain areas of the State where the soils contain the types of rock (gneiss, schist and granite) that have naturally higher concentrations of uranium and radium. Eight counties in North Carolina appear to have the highest levels of radon, exceeding, on average, 4 pCi/L (pico curies per liter). These counties are Alleghany, Buncombe, Cherokee, Henderson, Mitchell, Rockingham, Transylvania and Watauga (55).

Alleghany County is among the 8 North Carolina Counties with predicted average indoor radon levels in the highest-range, greater than 4 pCi/L (56). According to county-level data provided by the NC Radon Program, the average radon level among 18 Alleghany County air samples reported in 2004 was 5.67 pCi/L (57).

Health Risks of Radon

The primary risk of exposure to radon gas is an increased risk of lung cancer. Smokers are at higher risk of developing radon-induced lung cancer than non-smokers. There is no evidence that other respiratory diseases, such as asthma, are caused by radon exposure, nor is there evidence that children are at any greater risk of radon-induced lung cancer than are adults (58).

In recent years, the US EPA has worked with the National Academy of Sciences to update the estimates of lung cancer risks from indoor radon. The EPA's updated best national estimate of annual lung cancer deaths from radon is about 21,000 (59). Table 13 shows the lifetime risk of lung cancer death per person from radon exposures of certain levels in homes.

Table 13. Lifetime Risk of Lung Cancer Death (per person) from Radon Exposure in the Home

Radon Level (pCi/L)	Never Smokers	Current Smokers	General Population
20	36 out of 1,000	260 out of 1,000	110 out of 1,000
10	18 out of 1,000	150 out of 1,000	56 out of 1,000
8	15 out of 1,000	120 out of 1,000	45 out of 1,000
4	73 out of 10,000	620 out of 10,000	230 out of 10,000
2	37 out of 10,000	320 out of 10,000	120 out of 10,000
1.25	23 out of 10,000	200 out of 10,000	73 out of 10,000
0.4	73 out of 100,000	640 out of 100,000	230 out of 100,000

NB: Assumes constant lifetime exposure in homes at these levels

Source: US EPA. Air. Indoor Air Quality. Radon. Assessment of Risks from Radon in the Home. Available at http://www.epa.gov/radon/risk_assessment.html. (Accessed February 2007).

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 (60).

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 (61). 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 ().

A 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 (62).

According to CDC data (63), 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).

Table 14. Prevalence of Cigarette Smoking Among Adults, and Children’s Exposure to Environmental Tobacco Smoke, North Carolina and United States, Percent of Households except as noted, 1996

	Current Smoker	Current Smoker	Smoking Allowed in	Children Exposed to ETS	
	% of Adults ≥ 18	and Children in the Home	All or Some Areas of the Home	No. Children	% Children
North Carolina	25.7%	10.1%	87.5%	416,544	26.1%
United States	23.6%	9.8%	87.5%	229,446	23.1%

Source: Centers for Disease Control and Prevention. (November 7, 1997). State-Specific Prevalence of Cigarette Smoking among Adults, and Children’s and Adolescents’ Exposure to Environmental Tobacco Smoke – United States, 1996. *MMWR. Weekly Report*, 46(44), 1038.

According to the 2006 Behavioral Risk Factor Surveillance System Survey, 22.1% respondents statewide self-identify as “current smokers”. No comparable county-specific BRFSS data exist for Alleghany County, but according to *regional* BRFSS data (which includes respondents from Alleghany, Ashe, Avery, Watauga, and Wilkes counties), 19.6% of respondents self-identified as “current smokers” in 2006 (64).

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, the percent of North Carolina households allowing smoking in all or some areas of the home, or having no rules about smoking, had decreased dramatically to 27.7%; the percent dropped even further by 2006, to 24.8% (65). The percentage of households allowing smoking in the BRFSS region including Alleghany County was 34.0% in 2004 and 26.6% in 2006 (Table 15).

Table 15. BRFSS Results: Household Smoking Policies, Percent of Responses, 2004 and 2006

	Not Allowed Anywhere		Allowed in Some Places		Allowed Anywhere		No Rules About Smoking	
	2004	2006	2004	2006	2004	2006	2004	2006
Ashe Region	66.0	73.3	9.7	6.1	8.6	3.3	15.7	17.2
North Carolina	72.3	75.2	8.1	8.2	7.0	4.2	12.6	12.4

Source: NC State Center for Health Statistics. 2004 & 2006 BRFSS Survey Results: North Carolina. Second Hand Smoke Policy. NC Statewide; Alleghany, Ashe, Avery, Watauga, and Wilkes counties. Available at <http://www.schs.state.nc.us/SCHS/brfss/2006/index.html>. (Accessed October 2007).

Indoor Air Quality Regulations and Policies

Smoke-Free Workplaces

North Carolina does not have a complete inventory of smoke free workplaces. However, WorkingSmokeFree.com is a website where workplaces may voluntarily register their smoke free status. There are no workplaces in Alleghany County on record as being officially smoke free (66). Similarly, StepUp NC provides a voluntary registry of smoke free restaurants available at <http://stepupnc.com/do/smokefreedining.htm> (67).

Data summarized by the American Lung Association (68) 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 (69). 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 (70).

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. On July 18, 2007, Governor Easley signed Senate Bill 1086 which requires all North Carolina public schools to be 100% tobacco-free by August 2008 (71). As of September 2007, 86 of North Carolina's 115 School districts had adopted 100% Tobacco-Free policies, Alleghany County Schools were among them (72).

The Northwest Tobacco Prevention Coalition

In addition to the governmental regulations and policies cited above, the Northwest Tobacco Prevention Coalition serves Alleghany, Ashe, Caldwell, Watauga, and Wilkes counties to help eliminate exposure to secondhand smoke, promote tobacco cessation, prevent youth initiation of tobacco use, and identify and eliminate tobacco-related disparities in specific populations. Using funding from the Centers for Disease Control and Prevention as administered by the Tobacco Prevention and Control Branch within the NC Department of Health and Human Services, the coalition partners with local health departments to generate several projects and initiatives towards its stated goals (73).

One such project is the Indoor Air Quality Monitoring Report which measures the levels of particulate air pollution in restaurants in order to help understand the serious health risks of secondhand smoke. In 2007, a comparison of Watauga County restaurants showed that air quality was 4.5 times worse in mixed restaurants (with separate smoking and nonsmoking sections) than in smokefree restaurants. Restaurants allowing smoking throughout had 11 times worse air quality than smokefree restaurants (.). An Indoor Air Quality Monitoring

Project for Alleghany County venues is planned for January, 2008. Results (not including specific restaurant names) will be released to the general public and reported to community stakeholders, including the Appalachian District Board of Health.

The coalition also conducts campaigns to increase the number of smokefree restaurants and businesses. As of July 2007, 43% of Alleghany County restaurants are smokefree. The coalition also took part in the design and distribution of a smoking cessation toolkit which contains information regarding cessation and secondhand smoke dangers. The toolkit included a "prescription pad" to provide a concise and effective way to communicate facts ().

Lastly, the coalition works with the Families in Smokefree Homes (FISH) Project which is a cessation counseling program for pregnant women. Evaluation of the FISH project has demonstrated success in reducing tobacco use in participants, lowering incidence of premature birth, and increasing the number of higher birthweights for participants who reduce or quit smoking ().

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 (74), 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 ().

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.

An Industrial Hygiene Consultant in the Occupational and Environmental Epidemiology unit in the Epidemiology Section of the NC Division of Public Health maintains a database of city and county level data on indoor air quality complaints received during intake calls, including the type of facility, the type of complaint, and the complainant. However, it is important to note that this database requires the initiative of complainants and therefore may be subject to fluctuations of public awareness about indoor air quality hazards. In 2005 and 2006, there were no indoor air quality complaints in Alleghany County (75).

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 (76). Outdoor triggers include high levels of ozone and particulate pollution, which have been associated with 10-20% of all respiratory hospital visits and admissions (77).

Asthma Mortality

According to data from the CDC (78), 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 2005, there were 7,617 respiratory disease deaths statewide, 107 of which were attributed to asthma. In Alleghany County in 2005 there were sixteen deaths due to respiratory diseases, one of which was attributed specifically to asthma (79).

Asthma Morbidity

Prevalence. The prevalence of asthma in the US 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 (80).

According to CDC data based on the national BRFSS 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% (81). According to the 2006 BRFSS Survey, the five county region that includes Alleghany County, the lifetime prevalence of asthma in the region was 9.6%; statewide, the comparable figure for lifetime asthma prevalence was 10.9% (82).

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 (83). 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 Alleghany County was 4%, while the prevalence of undiagnosed wheezing was 18%. Based on these findings, Alleghany County ranked 1st of all NC counties for prevalence of diagnosed asthma, and 56th for undiagnosed wheezing (84).

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 2005, there were 18 asthma-related hospital discharges among the total population in Alleghany County, equaling a hospitalization rate of 165.0 per 100,000, compared to a rate of 128.5 per 100,000 for the State as a whole. Among children aged 0-

14, the 2005 Alleghany County hospitalization rate was 233.1 per 100,000, compared to a statewide hospitalization rate of 164.6 per 100,000 (85).

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/m³ increase in particulate matter, with respiratory mortality increasing 3.4% and cardiovascular mortality increasing 1.4% (86).

Rates of cardiovascular and respiratory disease in Alleghany County are discussed thoroughly in Volume 1 (Demographic, Socioeconomic and Health Data) of the Alleghany 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 entirely realistic (87).

In 2002, North Carolina ranked among the 20% dirtiest states in the US in terms of total major chemical releases to the environment, ranking 12th out of 56 US states and territories (88). Of the 80 North Carolina counties ranked in 2002, Alleghany is listed as 76th and it ranks among 10% of cleanest 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 (89). Table 16 compares the releases among these three counties. Total Alleghany County Releases decreased 61% 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
Alleghany	76	288	Glycol Ethers	250	Air
Davie	80	1	Lead Compounds	1	Air

Source: Scorecard, Pollution Locator, Toxic Chemical Releases. Available at: http://www.scorecard.org/ranking/rank-counties.tcl?fips_state_code=37&type=mass&category=total_env&modifier=na&how_many=100 (Accessed January 2007).

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 18th 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 (). All of TRIs in Alleghany County are released into the air (90). 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 (), but 0% of the total in Alleghany County (). 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%) (), and make up 0% of releases in Alleghany County (). The following section identifies the primary point sources and health risks associated with the most abundant pollutants emitted in Alleghany County.

In 2002 the Alleghany County facilities releasing the most TRI chemicals were, in decreasing order of significance, the Pioneer Eclipse Corp. in Sparta (250 pounds of Glycol Ethers) and the Bristol Compressors-Sparta Inc. in Sparta (38 pounds of Copper Compounds). It should be noted that while total TRI chemical releases were reduced in Bristol Compressors-Sparta Inc. by 85% between 1988 and 2002, total environmental releases *increased* by 5% at the Pioneer Eclipse Corporation ().

Alleghany County ranks 73rd in the State (out of 81 ranked counties) in terms of production related waste – 31,434 pounds compared to the worst county, New Hanover with almost 174 *million* pounds of total production-related waste (). 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 Alleghany County facilities generating the most production-related waste include, in decreasing order of significance, the same two facilities cited above: Bristol Compressors-Sparta Inc. (30,080 pounds of Copper Compounds) and Pioneer Eclipse Corp. (1,354 pounds of primarily Glycol Ethers). The former increased its production-related waste from 1991-2002 by 4423%, the latter by 315% ().

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 (91).

Alleghany County does not rank out of the 66 counties ranked in North Carolina for overall cancer risk score (92); it ranks 66th in overall non-cancer risk score (93). Table 17 lists the non-cancer risk scores (94) and sources of the major chemical releases in Alleghany County. Copper compounds were the leading noncancer risk TRI releases.

Table 18 details the health effects of the chemicals contributing most to the non-cancer risk scores of TRI releases in Alleghany County (95).

Table 17. Alleghany County Major Noncancer Risk TRI Releases, 2002

Chemical	Noncancer Risk Score (Pounds of toluene- equivalents)	Major Source	Pounds of Toluene- Equivalents
Copper Compounds	510,000	Bristol Compressors – Sparta, Inc.	510,000

Source: Environmental Defense. Scorecard. Pollution Rankings. Toxic Chemical Releases. Ranked by Noncancer Risk Score. Available at: http://www.scorecard.org/env-releases/county-health-impact-detail.tcl?fips_county_code=37005&cancer_p=0. (Accessed April 2007).
Source: Environmental Defense. Scorecard. Pollution Locator. By Counties in North Carolina. Facilities Contributing to Non-cancer Hazards. Available at: http://www.scorecard.org/ranking/rank-facilities-in-county.tcl?how_many=100&drop_down_name=Noncancer+risk+score&fips_state_code=37&fips_county_code=37005&sic_2=All+reporting+sectors (Accessed April 2007).

Table 18. Health Effects of TRI Chemicals Released in Alleghany County

Copper Compounds	Suspected kidney toxicant and respiratory toxicant.
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Source: Environmental Defense. Scorecard. Chemical Profiles. Available at: <http://www.scorecard.org/chemical-profiles/index.tcl> (Accessed April 2007).

Land Contamination

Superfund Sites

Alleghany 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 31 North Carolina Superfund Sites are scattered statewide in 20 counties and of those, none are in the same region as Alleghany County (96).

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 May 10, 2007, 97 Brownfields Agreements had been negotiated in North Carolina; there were 119 active eligible projects and 6 more pending. One active eligible project is located in Alleghany County: the Sparta Teapot Museum at 115 Atwood Street in Sparta (97).

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 no such sites in Alleghany County (98).

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 (99).

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 (100).

HSEES Events in Alleghany County

There were no such events for Alleghany County reported between 1998 and 2001 ().

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. Recent news coverage has directed attention to lead levels in children's toys.

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 US Census provides data for both of these risk factors to help estimate potential lead hazards in housing (101). When Alleghany County is compared to other North Carolina counties, it ranks 31st out of the 50 counties ranked for percent of housing units at high risk for lead hazards; it ranks 33rd out of 50 for percent of housing units with low income, and 36th out of 50 for the percent of children under 5 living below poverty level. It is not listed or ranked for the other risk factors as shown in Table 19 (102). However, data for all risk factors are still available.

Table 19. Alleghany County Lead Hazard Indicators, 1999

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.	%
120	3	660	n/a	830	18	180	32

Source: Scorecard, Pollution Rankings. Lead Hazards. County Report. Available at http://scorecard.org/env-releases/lead/county.tcl?fips_county_code=37005. (Accessed February 2007).

Childhood Blood Lead Levels

According to statistics provided by the State, the percentage of Alleghany County children screened for lead has been above the State average for children aged one and two years for the three most recent reporting periods (Table 20). Of those children screened during this period, a lower or equal percentage of children in the County tested positive for elevated lead levels than in the State as a whole in the two most recent periods. Table 21 presents the screening results for children ages six months to six years. The percentages of children with high blood lead levels (10-19 µg/dL) in Alleghany County were higher than North Carolina in two of the four most recent reporting periods. Blood lead levels >20 µg/dL were higher in North Carolina than in Alleghany County in all of the reporting periods (103).

Table 20. Alleghany 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	Alleghany	178	99	55.6	65.2	9	0.9
	NC	238,065	96,623	40.6	56.1	873	0.9
2004	Alleghany	180	95	52.8	-	0	0
	NC	235,599	92,057	39.1	-	1,167	1.3
2003	Alleghany	204	84	41.2	49.6	4	4.8
	NC	235,419	87,993	37.4	55.9	1,716	2.0
2002	Alleghany	230	79	34.3	41.1	2	2.5
	NC	238,359	86,212	36.2	54.5	1,614	1.9

NB: Dashes indicate data are not available.

Source: NC Division of Environmental Health. Children's Environmental Health Branch. Available at http://www.deh.enr.state.nc.us/ehs/Children_Health/Lead/Surveillance_Data_Tables/surveillance_data_tables.html. (Accessed January 2007).

Table 21. Alleghany 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	Alleghany	156	0	0	0	0
	NC	128,249	299	0.23	53	0.04
2004	Alleghany	137	1	0.73	0	0
	NC	124,486	349	0.28	52	0.04
2003	Alleghany	122	0	0	0	0
	NC	121,697	467	0.38	38	0.03
2002	Alleghany	108	1	0.93	0	0
	NC	120,966	461	0.38	68	0.06

Source: NC Division of Environmental Health. Children's Environmental Health Branch. Available at http://www.deh.enr.state.nc.us/ehs/Children_Health/Lead/Surveillance_Data_Tables/surveillance_data_tables.html. (Accessed January 2007).

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, but at the present time 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.

Alleghany County Agricultural Census

In 2002 Alleghany County was home to 544 farms, totaling 72,627 acres, 17,329 of which is harvested cropland. The average farm size in Alleghany County is 134 acres. Crops in Alleghany County include tobacco, corn, and hay. (Note: grapes and Christmas trees are not considered crops per se, and will be discussed separately.) Livestock raised in the County includes cattle, beef cows, and milk cows. Crops account for the majority of cash receipts, bringing in \$23.7 million in 2004 and ranking 42nd in the State (104). A summary of agricultural crop production in Alleghany County for 2006 is shown in Table 22; livestock production for 2002 is summarized in Table 23. Cash receipts for 2003 are shown in Table 24.

Table 22. Crops Grown in Alleghany County, 2006

Crop	Acres Planted	Acres Harvested	Yield per Acre	Production	State Rank
Tobacco, lbs.*	Not Available	200	1,855	371,000	56
Cotton, 480 lb. bales	-	-	-	-	-
Soybeans, bu.	-	-	-	-	-
Corn, bu.	-	-	-	-	-
Corn for silage, tons	Not Available	2,100	20	41,700	4
Peanuts, lbs.	-	-	-	-	-
Wheat, bu.	-	-	-	-	-
Barley, bu.	-	-	-	-	-
Oats, bu.	-	-	-	-	-
Sweet potatoes, Cwt.	-	-	-	-	-
Irish potatoes, Cwt.	-	-	-	-	-
All hay, tons	Not available	11,000	2.5	27,500	21
Sorghum, bu.	-	-	-	-	-

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

NB: A single asterisks denotes data is from 2005.

Source: NC Department of Agriculture and Consumer Services. Agricultural Statistics Division. County Estimates. County Estimates by Commodities. Available at http://www.agr.state.nc.us/stats/cnty_est/cnty_est.htm. (Accessed January 2007).

Table 23. Livestock Raised in Alleghany County, 2002

Stock	Number of animals
Cattle	18,793
Hogs and pigs*	28
Broilers and other meat type chickens	NA
Poultry	
Layers	238
Turkeys*	0
Sheep and lambs	412
Total	19,443

NB: Asterisks indicate data from 1997 because 2002 data are not available.
Source: United States Department of Agriculture. National Agricultural Statistics Service. 2002 Census of Agriculture – Volume 1 Geographic Area Series Census, State – County Data. Alleghany County: Tables 11, 12, 13, 16. Available at: http://www.nass.usda.gov/Census/Create_Census_US_CNTY.jsp . (Accessed February 2007).

Table 24. Cash Receipts in Alleghany County, 2004

Cash Receipts	Dollars	State Rank
Livestock, Dairy, and Poultry	16,660,000	52
Crops	23,794,000	42
Government Payments	434,000	57
Total	40,888,000	57

Source: NC Department of Agriculture and Consumer Services. Agricultural Statistics Division. County Estimates. County Estimates by Commodities. Available at http://www.agr.state.nc.us/stats/cnty_est/cnty_est.htm. (Accessed January 2007).

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 (105).

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 on Crops

Table 25 list the agricultural chemicals applied to the corn in Alleghany County in 2006 according to the NC Department of Agriculture and Consumer Services (106). NB: the Department does not list agricultural chemicals applied to tobacco and hay. In 2006, there

were 27,048 pounds of pesticide applied to corn with alchlor being the most heavily applied pesticide.

Table 25. Corn: Agricultural Chemical Applications, Alleghany County, 2006

Chemical	Rate per Application	Rate per Crop Year	Pounds per Year
	Pounds per Acre		
Herbicides:			
2,4-D	.36	0.40	840
Alachlor	1.82	1.82	3.822
Ametryn	1.12	1.12	2.352
Atrazine	1.18	1.22	2.562
Dichlorprop	0.26	0.31	651
Glyphosate	0.69	1.00	2.100
Linuron	0.80	0.80	1.680
Metolachlor	1.35	1.35	2.835
Nicosulfuron	0.02	0.02	42
Paraquat	0.50	0.52	1.092
Rimsulfuron	0.01	0.01	21
S-Metolachlor	1.10	1.10	2.310
Simazine	1.14	1.14	2.394
Total herbicides			1575.147
Insecticides			
Chlorpyrifos	1.06	1.06	2.226
Terbufos	1.01	1.01	2.121
Total insecticides			4.347
NB: Values in "Pounds per Year" column were calculated by multiplying the rate per crop year by the acres harvested for the crop (found in Table 22). The values for acres planted would have been used except that the data was not available.			
Source: NC Department of Agriculture and Consumer Services. Agricultural Statistics Division. Environmental Statistics. Agricultural Chemical Applications. Available at http://www.agr.state.nc.us/stats/otherept.htm#county . (Accessed January 2007).			

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 (107).

Below in Table 26 is the EPA's assessment of the health risks and health effects of the herbicides, insecticides, and fungicides applied on Alleghany County crops as listed in the agency pesticide re-registration database (108). The list is not comprehensive of all pesticides used; only those used most heavily by weight are included.

Table 26. Characteristics of Pesticides in Highest Use (by weight) in Alleghany County

Pesticide	Lbs/Year	Class	Toxicity	Health Risks/Effects
Herbicides				
Alachlor	3,822	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	2,835	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
Atrazine	2,562	Triazie herbicide registered for control of broadleaf weeds and some grassy weeks; inhibits photosynthesis	Unavailable	Low acute toxicity; acute and chronic dietary risk from food is not of concern; not expected to be significant contributor to drinking water risk; acute dietary assessment is delayed ossification in offspring and delayed body weight gain in adults; toxicity endpoint for short term occupational and residential assessment is delayed puberty; toxicity endpoints for chronic dietary, occupational, and residential assessments is surge of pre-ovulatory lutenizing hormone (LH); slightly acutely toxic to birds and mammals; moderately toxic to freshwater fish; highly acutely toxic to aquatic invertebrates
Simazine	2,394	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	2,352	Herbicide for non-residential use	III (oral) or IV (dermal)	Established tolerances for residues on food; low drinking water of dietary risk; protection recommended for handlers
S-Metolachlor	2,310	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

Insecticides

Chlorpyrifos	2,226	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	2,121	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)

NB: There are four classes of acute toxicity, ranging from I (very highly or highly toxic) to IV (practically non-toxic).

Source: Environmental Protection Agency. Pesticides. Regulating Pesticides. Re-registration. Re-registration Status. Available at <http://cfpub.epa.gov/oppreff/reereg/status.cfm?show=rereg>. (Accessed January 2007).

Pesticide Residues in/on Food

According to an employee of the NC Department of Agriculture's Product Testing unit (109) 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, however it was not in Alleghany County. None occurred statewide between 2000 and 2004, but one occurred in 2000; this poisoning was also not in Alleghany County (110).

Viticulture

North Carolina ranks 10th in the United States for wine and grape production and has a total of 61 wineries in 34 counties. The State had 1,300 bearing acres of grapes in 2006, with a production rate of 3.52 indicating total production at 4,580 tons. This is a marked increase from ten years earlier where there were 480 bearing acres, a production rate of 2.50, and a production of 1,200 tons. The North Carolina Wine Council lists two wineries in Alleghany County: Chateau Laurinda and Thistle Meadow Winery (111).

The NC Department of Agriculture and Consumer Services does not collect county-level data on grape production, nor does it provide information on pesticide application to grape crops. However, North Carolina State University provides data on commonly used pesticides as shown in Table 27 (112)

Table 27. Commonly Used Grape Pesticides

Application Time	Name	Type of Pesticide	Level of Toxicity
Dormancy – Shatter	Mancozeb	Fungicide	Slightly toxic; less than one pint can kill an adult
	Nova	Fungicide	Moderately toxic; less than two tablespoons can kill an adult
	Abound	Fungicide	Slightly toxic; less than one pint can kill an adult
	Vanguard	Fungicide	Slightly toxic; less than one pint can kill an adult
	Sevin	Insecticide	Moderately toxic; less than two tablespoons can kill an adult
	Princep	Herbicide	Slightly toxic; less than one pint can kill an adult
	Surflan	Herbicide	Slightly toxic; less than one pint can kill an adult
	Gramoxone Max	Herbicide	Highly toxic; less than one teaspoon can kill an adult
First Cover – Harvest	Roundup Ultramax	Herbicide	Slightly toxic; less than one pint can kill an adult
	Nova	Fungicide	Moderately toxic; less than two tablespoons can kill an adult
	Elevate	Fungicide	Slightly toxic; less than one pint can kill an adult
	Vanguard	Fungicide	Slightly toxic; less than one pint can kill an adult
	Captan	Fungicide	Highly toxic; less than one teaspoon can kill an adult
	Sevin	Insecticide	Moderately toxic; less than two tablespoons can kill an adult
	Imidan	Insecticide	Moderately toxic; less than two tablespoons can kill an adult
	Lorsban	Insecticide	Moderately toxic; less than two tablespoons can kill an adult
Post Harvest	Pyramite	Insecticide	Moderately toxic; less than two tablespoons can kill an adult
	Gramoxone Max	Herbicide	Highly toxic; less than one teaspoon can kill an adult
	Mancozeb	Fungicide	Slightly toxic; less than one pint can kill an adult
	Kerb	Herbicide	Slightly toxic; less than one pint can kill an adult
	Select	Herbicide	Moderately toxic; less than two tablespoons can kill an adult

Source: North Carolina State University. Department of Environmental and Molecular Toxicology. Extension. Links of Interest. Publications. Pesticides and human health: grapes. Names and Application Times of the Most Common Grape Pesticides. Available at <http://www.tox.ncsu.edu/extension/pdfs/Grape-English.pdf>. (Accessed August 2007).

Horticulture

North Carolina ranks 2nd in the United States for Christmas tree production and provided \$57.6 million in revenue in 2002. Information regarding the total acreage of Christmas tree

production in the State was not available at press time. Alleghany County is ranked 3rd in North Carolina and 12th in the United States for Christmas tree production. Christmas trees are one of the county's top agricultural products. In 2002, Alleghany County produced 4,574 acres of cut Christmas trees, bringing in almost \$8.8 million (113).

As with viticulture, the NC Department of Agriculture and Consumer Services does not provide information on pesticide application in horticulture. However, North Carolina State University and the NC Cooperative Extension provide data on commonly used pesticides. On average, 0.5 ounces of pesticides are used over the life of a Christmas tree. Based on two surveys distributed to members of the Christmas tree industry (in total representing over 600 growers and 21,000 acres), Table 28 lists pesticides and associated health effects that are used on at least 3% of Christmas tree acreage (114).

Table 28. Commonly Used Christmas Tree Pesticides

Chemical Name	Toxicology Information
Insecticide	
Di-Syston 15 G	Highly toxic via ingestion, inhalation, and dermally in humans. No chronic effects were noted, however rats showed reproductive effects and at high levels, teratogenic effects. Mutagenic effects were noted on bacteria. There is no evidence of a carcinogenic effect.
Lindane	Moderately toxic via ingestion, inhalation, and dermal exposure in humans. No observable chronic effects in mice, rats, or dogs. Rats showed reproductive and teratogenic effects. No mutagenic or carcinogenic effects were found in mice.
Dimethoate	Moderately toxic via ingestion, inhalation, and dermally in humans. No chronic effects were noted, however, in mice there were both reproductive and mutagenic effects. Rats showed teratogenic and carcinogenic effects.
Asana	Moderately toxic orally, slightly toxic dermally, non-toxic via inhalation in humans. No chronic, reproductive, teratogenic, mutagenic, or carcinogenic effects were shown in laboratory animals.
Lorsban	Moderately toxic ingestion and inhalation, and in a limited capacity dermally, in humans. Chronic toxicity resulted in the same effects as acute exposure. No reproductive, teratogenic, mutagenic, or carcinogenic effects were found in laboratory animals.
Savey	Not available
Morestan	Not available
Herbicides	
Roundup	Nontoxic via ingestion and dermal exposure. Moderately toxic via inhalation in humans. No chronic, reproductive, teratogenic, mutagenic, or carcinogenic toxic effects were noted in laboratory animals.
Simazine	Slightly toxic via ingestion, inhalation, and dermal exposure in humans. No reproductive, teratogenic, mutagenic, or carcinogenic effects were shown in laboratory animals.
Goal	Not available
Vantage	Slightly toxic via ingestion. Nontoxic via ingestion and inhalation in humans. Reproductive effects were shown in laboratory animals, although teratogenic, mutagenic, and carcinogenic effects were not.
Stinger	Not available
Garlon	Not available
Crossbow	Not available

Sources: NC State University. North Carolina Cooperative Extension. Mountain Horticultural Crops Research and Extension Center. Programs. Christmas Trees. Christmas Tree Production in North Carolina. Christmas Tree Production and the Environment. Available at: <http://www.ces.ncsu.edu/fletcher/programs/xmas/environment/pesticides.html>. (Accessed August 2007).

Agricultural Animal Waste

In 1997 North Carolina had the dubious distinction of being among the 20% of 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, Alleghany County is ranked 37th with an output of 210,000 tons (115). Animal waste generation of between 1.5 and 4.5 *million* tons occurs in the North Carolina counties at the top of the ranking: Duplin, Sampson, Bladen and Wayne. Table 29 and

Table 30 detail the animal waste production in the County. The data for these tables comes from the National Agricultural Statistics Services (NASS). NASS publishes an agricultural census every five years; the most current census report is from 2002. Although other assessments are conducted annually, methods vary from year to year, therefore the NASS dataset has the most comprehensive and consistent data available.

Table 29. Inventory of Livestock Animal Head and Waste Production for Alleghany County, 1997 and 2002

	Number of Animals		Waste Production (tons/year)		Waste Rate (tons/year/head)	
	1997	2002	1997	2002		
Cattle	24,459	18,793	203,010	155,982	8.3*	
Hogs and pigs	28	NA	53	NA	1.9	
Poultry	Broilers and other meat type chickens	NA	NA	NA	0.024	
	Layers	155	238	7	11	0.047
	Turkeys	0	NA	0	NA	0.112
Sheep and lambs	639	412	256	165	0.4	
Total	25,281	19,443	203,326	156,158	-	

NB: NA = Data Not Available to avoid disclosing data on individual farms.

NB: Because the category of cattle is not subdivided into meat and dairy, the waste rate for beef cattle was used so that the total waste production would be an underestimate. The waste rate for dairy cattle (22.3) is almost three times the rate for beef cattle.

NB: Waste Production is equal to the number of animals times the waste rate.

Source: United States Department of Agriculture. National Agricultural Statistics Service. 2002 Census of Agriculture – Volume 1 Geographic Area Series Census, State – County Data. Alleghany County: Tables 11, 12, 13, 16. Available at: http://www.nass.usda.gov/Census/Create_Census_US_CNTY.jsp. (Accessed February 2007).

Source: NC State University. 2005 North Carolina Agricultural Chemicals Manual. Livestock Manure Production Rates and Nutrient Content. Available at: <http://www.lib.clemson.edu/agric/pdfs/LIVESTOCKMANUREPRODUCTIONRATESANDNUTRIENTCONTENT.pdf>. (Accessed February 2007).

Table 30. Percent of Total Livestock Number and Waste Production for Alleghany County, 1997 and 2002

	Percent of Animal Head		Percent of Waste Production		
	1997	2002	1997	2002	
Cattle	96.7%	96.7%	99.8%	99.9%	
Hogs and pigs	0.1%	NA	0.0%	NA	
Poultry	Broilers and other meat type chickens	NA	NA	NA	
	Layers	0.6%	1.2%	0.0%	0.0%
	Turkeys	0.0%	NA	0.0%	NA
Sheep and lambs	2.5%	2.1%	0.1%	0.1%	

NB: Percentages calculated from Table 29.

Source: United States Department of Agriculture. National Agricultural Statistics Service. 2002 Census of Agriculture – Volume 1 Geographic Area Series Census, State – County Data. Alleghany County: Tables 11, 12, 13, 16. Available at:

http://www.nass.usda.gov/Census/Create_Census_US_CNTY.jsp . (Accessed February 2007).

Source: NC State University. 2005 North Carolina Agricultural Chemicals Manual. Livestock Manure Production Rates and Nutrient Content. Available at: <http://www.lib.clemson.edu/agnic/pdfs/LIVESTOCKMANUREPRODUCTIONRATESANDNUTRIENTCONTENT.pdf>. (Accessed February 2007).

As of 2002, 96.7% of livestock in Alleghany County were cattle, making up 99.8% of the waste production (116, 117). 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.

Between 1997 and 2002, livestock farming in Alleghany County did not change dramatically, and as a result neither has animal waste production (Table 29). Cattle production decreased slightly (from 24,459 to 18,793 head) as did the production of sheep and lambs (from 639 to 412 head); however, the number of layers increased slightly (from 155 to 238 head). Trend data on hog production was not available.

It is important to note that concerns about the potential for contaminated air, groundwater, and drinking water from lagoon and sprayfield waste management systems in rural counties have led to a moratorium on hog farms. Since August of 1997, legislation has placed a temporary ban on the construction or expansion of hog farms that employ the use of lagoons and sprayfields. The moratorium was intended to allow counties to establish zoning ordinances that would regulate the siting of hog farms. Over the past ten years, the moratorium has been extended four times. In 2000, researchers began to explore technologies that more effectively treat and distribute agricultural waste (118, 119).

Chapter Six: Waste Management

Solid Waste Management

In FY 2004-2005, Alleghany County managed 8,828 tons of solid waste for a rate of 0.81 tons *per capita*. This figure represented a decrease of 44% 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 approximately 21% from 1991-1992 to 2003-2004 (120).

Landfills, Waste Drop-Off, and Recycling

Alleghany County does not currently operate a municipal solid waste landfill. The municipal solid waste landfill located on Service Road 1138 in Sparta is closed. However, there is a waste transfer facility located at 431 Osburn Road in Sparta (121, 122). The transfer facility is available to residents for garbage disposal and drop-off of recyclables. It is open Monday thru Saturday 7am-6:45p (123).

Wastewater Management

According to 1990 Census data (data not available for the 2000 Census), 999 Alleghany County housing units (19%) were on a year-round public sewer system and 4,134 residences (77%) had septic tanks or cesspools. An additional 211 housing units (4%) had some other form of sewage disposal, including individual sewer pipes into creeks, rivers and streams (straight pipes) or outhouses (124).

Alleghany County is not divided into water and sewer districts, nor does it have any county or regional wastewater treatment plants. However the Town of Sparta has a municipal wastewater treatment plant (125).

On-Site Wastewater Management

According to 1990 Census data cited above, approximately 19% of the County's residences were connected to year-round public sewer, meaning 81% had septic tanks or cesspools or some other mechanism of sewage disposal. 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. From January – May 2007, no package WWTPs in Alleghany County received a fine (126).

Local health departments are charged with inspecting and permitting on-site wastewater facilities. During FY 03-04, the Environmental Health Division of the Alleghany County Health Department made a reported 350 site visits, and issued no citations for violations; no

permits were revoked or suspended, but 1 inspection resulted in a denied construction or improvement permit (127).

Chapter Seven: Drinking Water

According to the 1990 Census (data are not available for the 2000 Census), 1,485 Alleghany County year-round housing units (28%) 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 2,646 units (50%) had an individual well as the primary source of water. A smaller number of units – 1,213, or 22% – obtained water from some other source, such as springs, creeks, rivers, lakes, ponds or cisterns (128).

Water Usage

Table 31 details the annual average rate of water usage in Alleghany 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.

As illustrated in Table 31, total water usage in Alleghany County remained the same from 1995 to 2000. During this time period while irrigation usage increased, livestock usage, municipal/community usage, industrial usage, and domestic usage all decreased.

Table 31. Average Annual Rate of Water Usage, Alleghany County, 1995 and 2000 (Millions of gallons per day)

	Domestic Usage	Municipal and Community Usage	Industrial Usage	Irrigation Usage	Livestock Usage	Total Usage
2000	0.40	0.36	0.00	1.69	0.44	2.89
1995	0.48	0.50	0.09	1.12	0.70	2.89

Source: Log Into North Carolina (LINC) Database Search. Topic Group: Environment, Recreation and Resources. Mineral, Water Resources. V1307, V1308, V1309, V1310, V1312, and V1313. Alleghany County. Available at http://data.osbm.state.nc.us/pls/linc/dyn_linc_main.show. (Accessed April 2007).

Drinking Water Systems

Currently, the EPA lists 34 water systems in Alleghany County (129). Five are *community water systems* that together serve 2,984 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. No community systems use surface water.

Table 32. Alleghany County Community Water Systems (April, 2007)

Water System Name	Number Served	Primary Water Source Type
High Meadows S/D	474	Groundwater
Jonah's MHP	36	Groundwater
Olde Beau Golf Club	270	Groundwater
Roaring Gap Club Inc	380	Groundwater
Town of Sparta	1,824	Groundwater

Source: Environmental Protection Agency. Envirofacts. Safe Drinking Water Information System (SDWIS). Safe Drinking Water Query. County Search. Available at <http://www.epa.gov/safewater/dwinfo/nc.htm> (Accessed January 2007).

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) (.). There were five reported health-based violations occurring in three systems in the period from 2000 through 2006 (Table 33).

Table 33. Alleghany County Public Drinking Water Systems Reporting Health-Based Violations, 2000-2006

System Name	Dates	Type of Violation	Contaminant	Population Served
Jonah's MHP	Jul 2006 – Dec 2025	OCCT Study Rec	Lead & Copper Rule	36
Jonah's MHP	Mar 2006 – Dec 2025	Public Education	Lead & Copper Rule	36
Olde Beau Golf Club	Jul 2001 – Jan 2003	Public Education	Lead & Copper Rule	270
Olde Beau Golf Club	Jul 2000 – Jan 2003	Public Education	Lead & Copper Rule	270
Roaring Gap Club Inc	Jul 2002 – Dec 2025	Public Education	Lead & Copper Rule	380

Source: Environmental Protection Agency. Envirofacts. Safe Drinking Water Information System (SDWIS). Safe Drinking Water Query, County Search. Available at <http://www.epa.gov/safewater/dwinfo/nc.htm>. (Accessed January 2007).
NB: To access violation information, you must click on each individual system name.

There are five *non-transient, non-community water systems*, which are systems that serve the same people, but not on a year-round basis in Alleghany County. They serve an estimated 760 people (.).

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 24 such systems in place in Alleghany County, serving an estimated 1,640 people (.).

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 Alleghany County from 2002 to 2005. Comparable data for North Carolina are provided for 2005 only. From 2002-2005, there was one case of *Campylobacter* in Alleghany County.

Table 34. Alleghany County Reported Cases of Food-, Water-, and Vector- Borne Diseases in Humans, 2002-2005

	2002	2003	2004	2005	NC (2005)
Campylobacter	0	1	0	0	672
Cryptosporidiosis	0	0	0	0	92
E. coli O157	0	0	0	0	--
E. coli (Shiga toxin-producing)	0	0	0	0	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	0	84
Listeriosis	0	0	0	0	34
Lyme disease	0	0	0	0	49
Rocky Mountain spotted fever	0	0	0	0	625
Salmonellosis	0	0	0	0	1,701
Shigellosis	0	0	0	0	202

NB: The table is limited to the primary food-, water-, and vector borne diseases found in North Carolina and is not the comprehensive list of diseases found from the following source.

Source: NC Division of Public Health, Epidemiology Section, General Communicable Disease Branch. Communicable Disease Control. Statistics. County Tables: Reported Cases, North Carolina, 2002-2005, County of Residence by Diseases and Year of Report. Available at <http://www.epi.state.nc.us/epi/gcdc.html>. (Accessed February 2007).

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 one positive human case of WNV in 2006, five cases in 2005, 2 cases in 2004, and 23 cases in 2003. Alleghany County had no human cases, but it had two wild bird cases, one in 2002 and one in 2003 (130).

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 2006 there were no positive human cases in North Carolina; there were none in 2005, one in 2004, and one in 2003. There were no reported human or non-human cases of EEE in Alleghany County from 2002-2006 ().

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.

La Crosse Encephalitis is the most common arbovirus affecting North Carolinians (DHHS). Transmission occurs most frequently after being bitten from an infected mosquito. LAC is a disease of the central nervous system with complications ranging from headaches and fever, to tremors and coma. From 2002-2006, there were 104 positive cases of LAC reported in North Carolina. There were no positive cases of LAC found in Alleghany County from 2003-2006 (,131).

In March 2007, the Appalachian District Health Department applied for and subsequently was awarded state aid in mosquito control to serve the 84,910 permanent residents and 3.3 million temporary residents in the 977 square miles that cover Alleghany, Ashe, and Watauga Counties. In 2006, 50 requests/complaints were made for mosquito control assistance. The Health Department requested almost \$1.5 million in state funds to pay for a mosquito control program to:

- Educate the public to the health hazard mosquitoes pose
- Educate the public in ways to reduce and eliminate sources for mosquito breeding
- Receive and respond to public complaints and concerns
- Practice surveillance through seasonal maintenance of light trapping sites in varying environments
- Develop and maintain up to date data on species breeding, location, and population trends
- Identify problem mosquito species and implement efficient control strategies
- Maintain regular control over potential high density breeding sites

- Practice viral surveillance through pooling samples and submitting them to the state for testing, as well as other methods in the future (132).

Rabies

The Communicable Disease Control Branch reports cases of rabies (133). Table 35 lists the number of cases of rabies in animals in Alleghany County from 2001 through 2006. Selected animal hosts, including all those with reported cases, are shown. From 2001-2006, there were 19 reported cases of rabies in Alleghany County, nine of which were in raccoons, four in skunks, four in cats, and two in a foxes ().

Table 35. Alleghany County Cases of Rabies in Animals, 2001-2006

	Bat	Cat	Cow	Dog	Fox	Skunk	Raccoon
2006	0	1	0	0	0	1	0
2005	0	1	0	0	1	0	1
2004	0	1	0	0	1	0	4
2003	0	1	0	0	0	3	3
2002	0	0	0	0	0	0	1
2001	0	0	0	0	0	0	0

Source: NC Department of Public Health. Epidemiology. Communicable Disease Control. Rabies. Available at <http://www.epi.state.nc.us/epi/rabies/state.html>. (Accessed January 2007).

Additionally, the Appalachian District Health Department provided information for rabies investigations and treatments for humans in Alleghany County from 2004-June 2007. In 2004, there were 8 investigations, all tested negative. In 2005, no persons tested negative and one tested positive for rabies. In 2006, four people tested negative and none tested positive. Lastly in 2007, eight people tested negative and seven people tested positive. From 2004 to June 2007, 39 people were in the process or had completed post exposure treatment for rabies (134).

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Appendix A Smokefree Dining In Alleghany County