ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

Public Health Assessment for

LOUDON COUNTY HAZARDOUS AIR POLLUTANTS
LOUDON COUNTY, TENNESSEE
MAY 12, 2006

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
Agency for Toxic Substances and Disease Registry

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment was prepared by ATSDR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) section 104 (i)(6) (42 U.S.C. 9604 (i)(6)), and in accordance with our implementing regulations (42 C.F.R. Part 90). In preparing this document, ATSDR has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate.

In addition, this document has previously been provided to EPA and the affected states in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. The revised document was released for a 30-day public comment period. Subsequent to the public comment period, ATSDR addressed all public comments and revised or appended the document as appropriate. The public health assessment has now been reissued. This concludes the public health assessment process for this site, unless additional information is obtained by ATSDR which, in the agency's opinion, indicates a need to revise or append the conclusions previously issued.

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PUBLIC HEALTH ASSESSMENT

LOUDON COUNTY HAZARDOUS AIR POLLUTANTS

LOUDON COUNTY, TENNESSEE

Prepared by:

The Tennessee Department of Health
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry
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FOREWORD

The following two paragraphs describe the beginnings of ATSDR and the purpose of public health assessments related to EPA's National Priorities List (NPL) sites. Following the second paragraph is a description of the public health assessment process for Loudon County.

The Agency for Toxic Substances and Disease Registry (ATSDR) was established by Congress in 1980 under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as the *Superfund* law. This action set up a fund to identify and clean up our country's hazardous waste sites. The Environmental Protection Agency (EPA) and the individual states regulate the investigation and clean up of the sites.

Since 1986, ATSDR has been required by law to conduct a public health assessment at each of the sites on EPA's National Priorities List (NPL). The aim of these evaluations is to identify if people are being exposed to hazardous substances and, if so, whether that exposure is harmful and should be stopped or reduced. (The legal definition of a health assessment is included on the inside front cover.) If appropriate, ATSDR and the Tennessee Department of Health (TDH) also conduct public health assessments when petitioned by concerned individuals. Public health assessments are carried out by environmental and health scientists from ATSDR and from the states with which ATSDR have cooperative agreements. The public health assessment program allows the scientists flexibility in the format or structure of their response to the public health issues. For example: a public health assessment could be one document or it could be a compilation of several health consultations; the structure may vary from site to site. Nevertheless, the public health assessment process is not considered complete until the public health issues at the site are addressed.

Exposure: As the first step in this evaluation, ATSDR and TDH scientists reviewed sampling data for hazardous air pollutants at one location in Loudon County. Generally, ATSDR and TDH do not collect their own environmental sampling data but review information provided by EPA, other government agencies, businesses, and the public. When there is not enough environmental information available, the report will indicate what further sampling data is needed.

Health Effects: If the review of the environmental sampling data shows that people have, are, or could come into contact with hazardous substances, ATSDR and TDH scientists evaluate whether or not these contacts may result in harmful effects, to the extent possible. ATSDR and TDH recognize that children, because of their play activities and growing bodies, may be more vulnerable to these effects. As a policy, unless data are available to suggest otherwise, ATSDR and TDH consider children to be more sensitive and vulnerable to hazardous substances than adults. Thus, the health impact to the children is considered first when evaluating the health threat to a community. The health impacts to other high risk groups within the community (such as the elderly, chronically ill, immunocompromised, and people engaging in high risk practices) also receive special attention during the evaluation. It is possible to do this only to the extent that population specific data is available.

ATSDR and TDH use existing scientific information, which can include the results of medical, toxicologic, or epidemiologic studies and data collected in disease registries, to determine the health effects that may result from chemical exposures. The science of environmental health is still developing, and sometimes scientific information on the health effects of certain substances is not available. When this is so, the report will suggest what further public health actions are needed.

Conclusions: This report will present conclusions about the public health threat, if any, posed by the hazardous air pollutants. Actions needed to protect public health will be identified and recommended in public health action plan.

ATSDR and TDH are primarily advisory agencies, so usually these reports identify what actions are appropriate to be undertaken by EPA, TDEC, other responsible parties, or the research or education divisions of ATSDR and TDH. However, if there is an urgent health hazard, ATSDR can issue a public health advisory warning people of the danger. ATSDR can also authorize health education or pilot studies of health effects, full-scale epidemiology studies, disease registries, surveillance studies or research on specific hazardous substances.

Interactive Process: The health assessment is an interactive process. ATSDR and TDH solicit and evaluate information from numerous city, state and federal agencies, the community, including industrial members of the community. ATSDR and TDH then share their conclusions with them. Agencies are asked to respond to an early version of the report to make sure that the data they have provided is accurate and current. When informed of ATSDR's and TDH's upcoming conclusions and recommendations, sometimes agencies will begin to act before the final release of a report.

Community: ATSDR and TDH also need to learn what concerns the community may have about the issue and its impact on their health. Consequently, throughout the evaluation process, ATSDR and TDH actively gather information and comments from the people who live or work near a site, including residents of the area, civic leaders, health professionals, and community groups. To ensure that the report responds to the community's health concerns, an early version is also distributed to the public for their comments. All the comments received from the public are responded to in the final version of the report.

Comments: Comments received during the public comment period (May 17 to July 10, 2005) were addressed by improvements incorporated in the document or responses to comments recorded in Appendix J of this document.

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List of Abbreviations

APC	Division of Air Pollution Control
ATSDR	Agency for Toxic Substances and Disease Registry
BCAAT	Breathe Clean Air Action Team
CDC	Centers for Disease Control and Prevention
CEDS	Communicable and Environmental Disease Services
COPD	Chronic Obstructive Pulmonary Disease
CREG	cancer risk evaluation guide (ATSDR)
DHHS	Department of Health and Human Services
EAC	Early Action Compact
EDF	Environmental Defense Fund
EEP	Environmental Epidemiology
EMEG	environmental media evaluation guide (ATSDR)
EPA	U.S. Environmental Protection Agency
HAPs	Hazardous Air Pollutants
IARC	International Agency for Research on Cancer
IRIS	Integrated Risk Information System
ISCST3	Industrial Source Complex Short Term Dispersion Model – Version 3
kg	kilogram
LCECDA	Loudon County Economic and Community Development Agency
MCL	maximum contaminant level
mg	milligram
$\mu g/m^3$	microgram per cubic meter
MOA	Memorandum of Agreement
MRL	minimal risk level (ATSDR)
NEI	National Emissions Inventory
NIEHS	National Institute of Environmental Health, an Institute within NIH
NIH	National Institutes of Health, part of DHHS
NOAEL	no observed adverse effect level
NO_x	nitrogen oxides
NPL	National Priorities List
NTP	National Toxicology Program, a program within NIEHS
PAH	polyaromatic hydrocarbon
PCB	polychlorinated biphenyl
PHA	Public Health Assessment
PHAP	Public Health Action Plan
PM	Particulate Matter
$PM_{2.5}$	"Fine particles" (such as those found in smoke and haze) which are 2.5 micrometers in diameter or less
PM_{10}	"Coarse particles" (such as those found in wind-blown dust), which have diameters between 2.5 and 10 micrometers.
ppb	parts per billion
ppbv	parts per billion by volume
RCRA	Resource Conservation and Recovery Act
RfC	reference concentration
RfD	reference dose (EPA)
RMEG	reference media evaluation guide (ATSDR)
SIP	State Implementation Plan
SMSA	Standard Metropolitan Statistical Area
TAPCB	Tennessee Air Pollution Control Board
TCR	Tennessee Cancer Registry
TDEC	Tennessee Department of Environment and Conservation
TDH	Tennessee Department of Health
TRI	Toxic Release Inventory
UATMP	EPA Urban Air Toxics Monitoring Program
VOC	Volatile Organic Compound
WHO	World Health Organization

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Summary

Local residents of Loudon County have been concerned about exposure to and health effects from pollutants emitted from several local industries for many years. In order to help respond to these concerns the Division of Air Pollution Control (APC), Tennessee Department of Environment and Conservation (TDEC) designed a Hazardous Air Pollutants (HAPs) study to look at emissions in the Town of Loudon, Loudon County. One monitoring location was selected based on air modeling results. In March 2004, APC asked the Tennessee Department of Health (TDH), Communicable and Environmental Disease Services (CEDS), Environmental Epidemiology (EEP), to identify possible health risks using the HAPs monitoring data collected in the industrial corridor.

EPA has determined that the Knoxville Region will be out of compliance with the new ozone and particulate air standards. Loudon County is included in the Knoxville Region, along with Anderson, Blount, Knox, Jefferson, Sevier, and Union Counties. While ozone and particulate non-attainment is a regional problem, each county makes unique contributions to the problem and will benefit from individual and regional solutions.

In addition to six industries with operating permits under Title V of the Clean Air Act Amendments of 1990 and five other large industries, Loudon County has two interstate highway systems with heavy tourist traffic for the Great Smoky Mountains National Park and fifteen motor freight carrier businesses. It is important to note that the Smoky Mountains are a source of many allergens because of the diversity of flora comprising its various ecological systems.

Of the 41 HAPs sampled and analyzed at the monitor, four were identified as chemicals of concern: benzene, carbon tetrachloride, acetaldehyde, and formaldehyde. Carbon disulfide, ozone, and particulate matter were considered carefully because of community concern. Formaldehyde monitored between November 15, 2003, and April 9, 2004, presented an indeterminate health hazard. There was no apparent public health hazard identified from exposure to formaldehyde monitored April 21, 2004, to December 24, 2005. No apparent health hazard was identified throughout the sampling period for benzene, carbon tetrachloride, and acetaldehyde. An indeterminate health hazard was identified for mixtures of HAPs, along with ozone, particulates, and allergens. An indeterminate health hazard was identified for the mixtures of HAPs, especially aldehydes, and for particulate matter and ozone.

In order to more thoroughly understand disease trends with respect to community concerns about respiratory and heart-related illnesses, analyses were performed for 40 specific diseases. Data available about these diseases included: 1) death certificate information from 1990 through 2003; 2) inpatient hospital discharge data from 1997 through 2003; 3) outpatient hospital discharge data from 1998 through 2001; and 4) Tennessee Cancer Registry (TCR) incidence case data from 1991 through 2000. Loudon County was compared to Franklin County and to the entirety of Tennessee. Franklin County was chosen as a comparison because it matched Loudon County closely in demographic measures.

Two findings from the health data are of significance:

1. a significantly increased rate of chronic rhinitis and sinusitis for Loudon County compared to Franklin County and Tennessee using in-patient and out-patient hospital records, and
2. Of all counties in Tennessee, Loudon County has the highest mean rate for all cancers combined, based on data from the Tennessee Cancer Registry.

The rate of ischemic heart disease was higher for both sexes combined, males, and females in Loudon County compared to Tennessee, but not Franklin County. The rate of bronchus and lung cancer was elevated for males when compared to Tennessee for all datasets. The incidence of prostate cancer was significantly higher than the rate for Franklin County and Tennessee, although the mortality rate was not different.

While the in-patient rates of chronic obstructive pulmonary disease, other respiratory diseases, and other heart diseases were higher among Loudon residents than Franklin and Tennessee residents, this increase was not observed in other data sources. Similarly, only out-patient rates for chronic bronchitis and acute upper respiratory diseases were consistently higher among Loudon residents when compared to Franklin County and Tennessee. The rates for other diseases do not show consistent patterns across datasets.

The Public Health Action Plan for Loudon County Hazardous Air Pollutants contains a description of action to be taken by TDEC, TDH, EEP, and others subsequent to the completion of this PHA. The purpose of the Public Health Action Plan is to ensure that the PHA not only identifies potential and ongoing public health hazards, but also provides a plan of action designed to mitigate and prevent adverse human health effects resulting from exposure to hazardous substances in the environment. The public health actions fall into 3 categories: continue to work with TDEC on potential health issues related to hazardous air pollutants (HAPs), more closely evaluate health outcome data, and provide education about allergens, air quality alerts, and ways to minimize exposures.

Purpose

In March 2004, the Tennessee Department of Environment and Conservation (TDEC), Division of Air Pollution Control (APC), asked the Tennessee Department of Health (TDH), Communicable and Environmental Disease Services (CEDS), Environmental Epidemiology (EEP), to determine the health risks from Hazardous Air Pollutants (HAPs) from data collected in an industrial corridor of Loudon County, Tennessee. In order to collect the air data, APC designed a HAPs study to look at emissions in an area where local residents were concerned about health effects from pollutants emitted from several local industries. One monitoring location was selected based on modeling results.

This Public Health Assessment (PHA) responded to the request, specifically by evaluating air data from the HAPs study and evaluating community concerns about environmental pollution in the area. The PHA responds to APC and to citizens' concerns and will assess whether the exposure to hazardous air pollutants measured by the HAPs study could impact public health. It will also identify any further studies or actions that may be needed. The PHA will not provide answers to causes of specific illnesses in individuals nor will it identify a specific source of hazardous air pollutants.

The Tennessee Department of Health, Communicable and Environmental Disease Services, Environmental Epidemiology prepared a draft Public Health Assessment which was released to government agencies, the general public, and local industries for comment. This final Public Health Assessment: Loudon County Hazardous Air Pollutants takes into account all comments received, either as changes to the document or responses to comments located in Appendix I.

Background

The geographic area currently known as Loudon County was first settled in the mid-eighteenth century by English soldiers who lived near the indigenous Overhill Cherokee Indians. The town of Loudon was begun in 1790 on the northern bank of the Tennessee River; a ferry was located there, followed by a steamboat landing. In 1848, the railroad came to Loudon (then known as Blair's Ferry); with a railroad terminus and a river port, Loudon became a popular site for transferring merchandise and produce from the river to the railroad. Before about 1980, the economy of Loudon County was based on agriculture, although the county was home to some textile mills.

The Loudon County Economic Development Agency (LCEDA) was formed in 1967 as the Loudon County Industrial Committee of 100; the name was changed in fiscal year 1999-2000. The core mission of the agency is: *Participate and encourage the creation of quality and lasting community and economic development programs which promote an exceptional pro-business climate that encourages capital investment business locations that contribute significantly to the local economy benefiting local government programs/services and that offer challenging and rewarding employment opportunities to the citizens of Loudon County* (LCECDA 2004). Programs and services of the LCEDA include location analysis, design assistance, permitting assistance, park development, and data sources.

Demographics

Loudon County is the fastest growing county in East Tennessee, with a population of about 41,000. Between 1990 and 2000, the county's population increased 25.1%. Population projections show the county's population increasing another 23% between 2000 and 2010. The median age for the county is 41 years, with 60% of residents between 18 and 64 years. More than 97% of the population was white in 2002. (LCECDA 2004).

Economically, Loudon County is doing well, in comparison with the State of Tennessee and the Knoxville Standard Metropolitan Statistical Area (SMSA). See the table below for comparisons.

Economic factors in Loudon County. Source, 2000 census data			
	Loudon County	State	Knoxville SMSA
Median household income	$40,401	$36,360	$36,875
Median family income	$46,517	$43,517	$45,697
Per capita personal income	$26,212	$19,393	$20,538

Regulatory and Community Efforts to Improve Air Quality

Loudon County is included in the Knoxville Region which is not meeting EPA's national air quality standards for ozone, along with Anderson, Blount, Knox, Jefferson, Sevier, and Union Counties. While non-attainment is a regional problem, each county makes unique contributions to the problem and will benefit from individual and regional solutions. The ozone standard is a three year average of the fourth highest daily maximum value each year for three years. The numerical value for the standard is 80 ppb. In 2004, the fourth highest reading was 77 ppb. Preliminary data indicates the fourth highest reading for 2005 was 83 ppb. Since the fourth highest value for 2006 is not yet known, a three year average for ozone cannot be calculated or predicted.

In addition to ozone attainment standards, TDEC was required by federal law to identify areas that do not meet EPA's national air quality standards for fine particulate matter ($PM_{2.5}$). Based on TDEC's most recent monitoring data and understanding of required federal guidelines, TDEC submitted Hamilton and Knox Counties as potential $PM_{2.5}$ non-attainment counties. On June 29, 2004, EPA announced its intent to designate a total of nine Tennessee counties as non-attainment for $PM_{2.5}$: Anderson, Blount, Hamilton, Knox, Loudon, Marion, McMinn, Roane and Sevier. In naming these additional counties, EPA felt that the additional counties significantly contributed to the $PM_{2.5}$ non-attainment of Hamilton and Knox counties. Preliminary data for 2005 indicate an average $PM_{2.5}$ for Loudon County of 16.1 microgram per cubic meter ($\mu g/m^3$), while the standard for the annual average is 15 $\mu g/m^3$; all measurements for 2005 were well below the 24-hour standard of 65 $\mu g/m^3$.

The Loudon County Air Quality Task Force was created by the Loudon County Commission, Lenoir City City Council, and Loudon City Council to:

- Define the present air quality within the County and region utilizing existing available resources including available monitoring stations as needed;

- Determine the extent to which major sources and nature of emissions contribute to air pollution within the County and region;
- Determine the impact of present air quality on public health and economic growth of the County and region and to forward recommendations to the legislative bodies as appropriate;
- Determine cost-effective ways in which major local sources of emissions can improve air quality in a voluntary program;
- Determine regulatory methods (if it is determined that such is necessary), including expected administrative costs, to effectively improve air quality within the County;
- Identify other issues influencing air quality emissions and methods to improve the overall air quality within the County and region; and
- Communicate and educate the community in regards to air quality and recommendations for improvement (Resolution).

Community Groups

In addition to the Loudon County Air Quality Task Force, there are two community groups active in working on Loudon County air quality issues.

The Breathe Clean Air Action Team

The Breathe Clean Air Action Team (BCAAT) began around three years ago to work on clean air issues. Most members of BCAAT live in Tellico Village, although some members live in the town of Loudon and other parts of Loudon County. BCAAT is a group of citizens committed to reducing chemical toxins, carcinogens, and noxious odors released into the air (BCAAT 2004). They are active in public awareness, education, research, fact finding, and advocacy with both government and local industry. BCAAT's 2004 priorities were to:

- Convince Loudon industries to install "appropriate emission controls" to dramatically reduce their toxic pollution.
- Convince TDEC that DuPont/Tate and Lyle construction permits should not be approved until Tate and Lyle's current toxic releases are significantly reduced.

Clean Air Friends-Clean Air Kids, Inc.

Another group, Clean Air Friends-Clean Air Kids, Inc., is a citizens' grassroots organization. According to their president they organized five to seven years ago when particulate matter began to concern some community members. The group meets monthly and is made up of a seven member board. Soon they plan to amend their charter to allow for new membership on the board. One of the priorities of the group is to encourage citizens to attend Title V Air Pollution Control hearings in their community by distributing flyers and presenting to community groups. The president identified two petitions as the group's greatest accomplishments. One petition, asking for health studies, received 3000 adult signatures and 250 student signatures. Another petition, encouraging better technology use to reduce emissions, received 850 signatures (Clean Air Friends-Clean Air Kids, Inc., personal communication, September 20, 2004).

Air Pollution Sources

Title V Companies

Loudon has six industries which hold operating permits under Title V of the Clean Air Act Amendments of 1990 and five companies which hold conditional major source air permits from TDEC Division of Air Pollution Control (APC). The Table 1 summarizes the area industries which have Title V permits or are major sources in Loudon County, with their allowable emissions as of May 18, 2004 (TDEC). A brief discussion of each follows.

Table 1. Allowable Air Emissions from Title V and Conditional Major Sources, Loudon County, Tennessee, May 18, 2004. Units of facility allowables in tons per year.

Title V Companies	Particulate Matter	Sulfur Dioxide	Nitrogen Oxides	Volatile Organic Compounds	Carbon Monoxide
Tate and Lyle	467	3878	2695	686	440
Viskase	130.95	837.75	39.24	1128	4.03
Kimberly-Clark	235.22	167.5	53.22	205.36	69.6
Trigen Biopower	81.89	233.41	239.57	230.44	232.42
Strongwell	63.75	NA	NA	224.53	NA
Malibu Boats	15.33	NA	NA	160	NA
Conditional Major Companies	**Particulate Matter**	**Sulfur Dioxide**	**Nitrogen Oxides**	**Volatile Organic Compounds**	**Carbon Monoxide**
Monterey Mushrooms	1.4	78.6	33	0.5	6.4
Greenback Asphalt	6.75	23.9	15.3	1.0	NA
Hutch Manufacturing Company	18.66	11.1	3.13	49.9	0.8
IMCO Recycling of Loudon	71.9	0.88	62.2	18.3	15.6
Petrostone Industries, LLC	49.7	NA	NA	24.9	NA

Tate and Lyle, formerly A.E. Staley Manufacturing Company, produces a variety of nutritive corn sweeteners widely used in the food and beverage industries, and they have a current Title V operating permit. The facility is located in Blair Bend Industrial Park. Corn is transported to the facility by barge. Tate and Lyle produces wet and dry corn gluten feed made from a combination of fiber, screenings, and steepwater. Tate and Lyle also produces ethyl alcohol and supplies customers with two grades of ethanol. One grade, denatured ethanol, is primarily used for blending with gasoline for use as motor fuel. The second, an industrial grade ethanol, is used for such varied applications as vinegar production to manufacturing plastics. Energy is supplied to the facility by natural gas, coal, and no. 6 fuel oil (APC permit, May 30, 2003). Air pollutants emitted from the facility include acetaldehyde, ethylene glycol, methanol, hydrochloric acid, and formaldehyde (APC permit application September 2002).

In 1998, A.E. Staley (now Tate and Lyle) received a Notice of Violation (NOV) as a result of Tate and Lyle voluntarily reporting previously unknown emissions of volatile organic compounds and sulfur dioxide and in 1999 received an Order for failure to submit Prevention of Significant Deterioration applications and to comply with the conditions of the operating permit. No other NOVs or Orders have been issued for this facility.

Viskase Corporation is located on Blair Bend Drive in the same industrial complex as Tate and Lyle. It is a cellulose food casing manufacturing plant, with a current Title V operating permit. Energy is supplied to the facility by coal with or without chopped dry waste cellulose, natural gas, or no. 1 or no. 2 fuel oils as a back-up fuel. Carbon disulfide is stored in two chemical storage tanks and used in the viscose process, leading to emissions of carbon disulfide and hydrogen sulfide. Carbon disulfide is the largest single air release in Loudon County, as detailed in the discussion of the Toxic Release Inventory in Appendix B. Viskase Corporation has received no NOVs.

Kimberly-Clark Corporation is located at 5600 Kimberly Way in Sugar Limb Industrial Park. Kimberly-Clark uses recycled paper in the form of dry cellulose pulp to manufacture bath tissue and paper towels. The Title V permit does not list any HAPS expected to be emitted by this industry. Kimberly-Clark received several NOVs between 1999 and 2005. These are summarized in Table 2.

Table 2. Compliance Enforcement Actions against Kimberly-Clark Corporation, Loudon County, Tennessee, November 1999 – July 2005

Date of NOV	Violation	Action Taken
July 13, 1999	No start-up certification	Order for $1,500
September 24, 2002	VOC exceedances	No further action
September 30, 2003	Emissions exceedance	No further action
December 21, 2004	Emissions exceedance	Order for $3,000
July 5, 1005	Record keeping	Pending

NOV = *Notice of Violation*
Order = *Issued by the Tennessee Air Pollution Control Board; may contain assessment of civil penalties*

Trigen Biopower, *Incorporated* has a Title V permit for one waste wood and paper sludge-fired boiler and two fuel oil-fired standby boilers. Trigen takes the sawdust and wood sludge from Kimberly-Clark, makes steam using it as a fuel source, and sells the steam to Kimberly-Clark. The permit lists no HAPs that are expected to be emitted. It is located at 5897 Sugarlimb Road, Loudon. Trigen received several NOVs between January 1995 and May 2000, followed by an Order and Assessment of Civil Penalty from the Tennessee Air Pollution Control Board in July 2000. These compliance enforcement actions are summarized in Table 2.

Table 3. Compliance Enforcement Actions against Trigen Biopower (formerly Power Sources), Loudon County, Tennessee, January 1995 – May 2004.

Date of NOV	Violation	Action Taken
December 4, 1995	Operating without a permit	Retracted per John Walton
January 17, 1996	Operating without a permit	Retracted per John Walton
January 24, 2000	Visible emissions evaluation	Order for $3,500
May 19, 2000	Visible emissions evaluation	2 NOVs combined. See above
October 8, 2001	Visible emissions evaluation	Retracted
April 21, 2004	Visible emissions evaluation	Order for $1,500
May 16, 2005	Exceedance	Pending

NOV = *Notice of Violation*
Order = *Issued by the Tennessee Air Pollution Control Board; may contain assessment of civil penalties*

Malibu Boats West, Incorporated is located at 5075 Kimberly Way, Loudon. The facility has a Title V permit for fiberglass boat manufacturing, which includes gelcoat, lamination, adhesive spraying, and grinding operations. The permit includes the volatile organic compound (VOC) group as possible emissions. Malibu Boats has been given three NOVs, two for late reports in June and July 2000 and one for open burning in January 2004.

Strongwell – Lenoir City has a Title V permit for the manufacture of polymer concrete products. It is located at 2911 Industrial Park Drive in Lenoir City. The permit lists the volatile organic compound (VOC) group as possible emissions. In 1999 Strongwell received an NOV for construction without a permit.

DuPont and Tate & Lyle PLC announced on May 26, 2004, a joint venture to create products from renewable resources such as corn for numerous applications including clothing, interiors, engineered polymers, and textile fibers. The new company, called DuPont Tate & Lyle BioProducts, LLC, plans to construct its initial commercial manufacturing plant in Loudon, Tennessee, with startup scheduled for 2006. A pilot facility in Decatur, Illinois, has been operating for several years. The joint venture will use a proprietary fermentation and purification process developed jointly by DuPont and Tate & Lyle to produce 1,3 propanediol (PDO), the key building block for DuPont Sorona polymer. Sorona polymer can be used in a variety of applications, including textile apparel, interiors, engineering resins, and packaging. An application for a construction permit for the new DuPont and Tate & Lyle venture will require a modification to Staley's existing Title V permit.

Conditional Major Air Pollution Sources

Conditional major sources of air emissions in London County are:

Greenback Asphalt Company, Incorporated, 2250 Big Hill Road, Lenoir City
Hutch Manufacturing Company, 200 Commerce Street, Loudon
IMCO Recycling, 388 Williamson Drive, Loudon
Monterey Mushrooms, 19748 Highway 72 N, Loudon
Petrostone Industries, LLC, 3620 Industrial Park Drive, Lenoir City.

See Figure 1 for a map of the area. Loudon County has several major road ways with heavy car and truck traffic. Interstate 40 (a major east-west route) merges with Interstate 75 (a major north-south route) in Loudon County. Several state highways connect to Knoxville. Interstates 40 and 75 provide access to Oak Ridge and the regional airport and connect the area to metropolitan Atlanta, Georgia. In addition, a bypass is planned for the Knoxville area, which will have impacts on roads used to connect the area with the Great Smoky Mountains. Fifteen motor freight carrier businesses are located in Loudon County.

IMCO Recycling of Loudon, 388 Williamson Drive, Loudon, is a secondary aluminum smelter. It is located in the same industrial corridor as Tate and Lyle and Viskase. Aluminum ingots from the Aluminum Company of America (ALCOA) in Blount County, Tennessee, are smelted, reformed, and sold back to ALCOA. IMCO has a history of violations of Rules of the Tennessee

Department of Environment and Conservation, Division of Air Pollution Control. These violations are summarized in Table 3.

Table 4. Compliance Enforcement Actions Against IMCO Recycling of Loudon, Loudon County, Tennessee, August 2001 – May 2004.

Date of NOV	Violation	Action Taken
August 24, 2001	No start-up certification	Order for $2,500
October 8, 2001	Visible emissions evaluation	3 NOVs combined
October 25, 2001	Visible emissions evaluation	3 NOVs combined
February 21, 2003	Visible emissions evaluation	Order for $10,500, on appeal
September 23, 2003	Visible emissions evaluation	Order for $6,000
September 30, 2003	Record keeping	4 NOVs combined
March 5, 2004	Dross storage violation	4 NOVs combined
March 26, 2004	Visible emissions evaluation	4 NOVs combined
February 11, 2005	Visible emissions evaluation	Order for $32,500
March 23, 2005	Vsible emissions evaluation	2 NOVs combined

NOV = *Notice of Violation*
Order = *Issued by the Tennessee Air Pollution Control Board; may contain assessment of civil penalties*

The other conditional major industries are not described because they are not clustered with other industries or because they have no violations or do not emit hazardous air pollutants.

Air Quality Monitoring Methods, Hazardous Air Pollutants, and Criteria Pollutants

Tennessee is participating in the EPA Urban Air Toxics Monitoring Program (UATMP); the Tennessee portion of the study began with a study site in the Kingsport area (Sullivan County) about 2 years ago. The EPA encouraged states and local air monitoring agencies to undertake these studies by providing the money and initial laboratory support for participation in the UATMP. The Tennessee study was expanded to include the City of Loudon and the City of Dickson (Dickson County) as study sites as a result of requests from local citizens who were concerned about odors, health effects, and the composition of emissions released to the air in their communities by neighboring industrial sources. The UATMP provided a unique method to assist in addressing these concerns given the requirements for monitoring extremely low ambient levels of the compounds of interest. The sampling that is conducted for air toxics is a 24-hour sample collected once every 12 days on the national schedule at all of Tennessee's sites. TDEC is continuing to operate the monitor and is planning a second HAPs monitor for Loudon County.

The hazardous air pollutant (HAPs) monitor in Loudon provides information about what chemicals are present in Loudon County air. Trying to determine exactly where measured chemicals come from is a difficult task. Some chemicals may come directly out of a manufacturing stack. Some come from exhaust pipes of cars and trucks, and others may come from agricultural, business, household, or natural sources. Some chemicals are blown in with the wind from other counties or even other states. In addition to direct sources, some chemicals measured by the HAPs monitor may be a breakdown product of another chemical.

APC attempted to identify the possible inventory of chemicals likely to be emitted to the air by Loudon County industries. The Toxic Release Inventory (TRI), National Emissions Inventory

(NEI), Title V permits and permit applications, and stack tests were all investigated to help elicit the actual emissions by compound and magnitude. The University of Tennessee in Knoxville (UTK) Department of Civil and Environmental Engineering performed air modeling analysis using the Industrial Source Complex Short Term (ISCST3) Dispersion Model – Version 3 to predict maximum annual and 24-hour average concentrations of particulate matter (PM) in three size ranges: less than or equal to 30 microns diameter (PM_{30}), less than or equal to 10 microns (PM_{10}), and less than or equal to 2.5 microns ($PM_{2.5}$) at receptors located throughout the modeling area, as well as the maximum annual and 1-hour average concentrations of acetaldehyde. Emissions from the following companies were modeled: Trigen-Biopower, Tate and Lyle (formerly A.E. Staley), Viskase, IMCO Recycling of Loudon, and Kimberly Clark. UTK also ran the Building Profile Input Program (BPIP) to account for any possible plume downwash conditions around buildings which are near stacks that are shorter in height than good engineering practice would dictate (Miller 2003).

The results of the model were used to help locate the monitoring site that was selected for the HAPs study. Viskase, Tate and Lyle, and IMCO are located in Blair Bend Industrial Park on the banks of the Tennessee River immediately across the river from downtown Loudon. A residential area begins on a ridge across Blair Bend Drive from the industrial complex. The HAPs monitor is located at the top of the ridge on Simmons Road in a resident's side yard.

Tennessee APC is following the sampling and analysis protocol for the Urban Air Toxic Monitoring Program. The compounds/chemicals of concern were selected by EPA and are analyzed by the EPA-contract laboratory, Environmental Research Group, which is set up to routinely run analysis for these compounds. Air toxics monitoring for Loudon began in November 2003 using ATEC dual channel toxics monitoring equipment capable of collection of both canister and cartridge samples simultaneously. The canister captures volatile organic compounds, while the cartridge collects aldehydes. See Appendix A for details of sampling data.

EPA uses six "criteria pollutants" as indicators of air quality, and has established for each of them a maximum concentration above which adverse effects on human health may occur. These threshold concentrations are called National Ambient Air Quality Standards (NAAQS). The six criteria pollutants are carbon monoxide, lead, nitrogen dioxide, particulate matter (PM_{10} and $PM_{2.5}$), ozone, and sulfur oxides.

$PM_{2.5}$ monitoring began on August 1, 2003, in Loudon County because of complaints raised about particulate emissions and particulate fallout by the local residents. Local residents had requested that ozone monitoring also be conducted. Ozone monitoring began in March 2004 at the beginning of the Tennessee regulatory ozone season (March 1 through October 31). Meteorological monitoring began on April 22, 2004, reporting hourly the parameters of wind speed and direction.

On July 18, 1997, the U.S. Environmental Protection Agency (EPA) revised the national standard for ground-level ozone from a 120 ppb (parts per billion) 1-hour "peak" standard to an 80 ppb 8-hour "average" standard. This became effective on June 15, 2005.

This new standard is commonly referred to as the *8-Hour Ozone Standard*, and its implications are twofold. First, the 8-hour standard is a more protective public health indicator in that it is based on a longer potential exposure period. The longer potential exposure period more accurately relates to chronic respiratory irritation and the aggravation of preexisting respiratory diseases like asthma than the 1-hour "peak" standard. Second, the 8-hour standard requires ozone emission standards be met over a longer time frame than the 1-hour "peak" requirement.

All areas of Tennessee met national ambient air quality standards (NAAQS) for the 1-hour peak standard for ozone prior to its June 15, 2005, revocation. However, Loudon County, along with other counties, may not be able to meet the 8-hour ozone standard and as a result, is categorized as a *non-attainment* area. When the non-attainment designation occurs, the State must recommend to EPA the boundaries of the areas that are not in compliance with the ground-level ozone standard, and must submit a plan to EPA that demonstrates how the State will bring those areas back into attainment. Also, when non-attainment designations occur, areas are subject to requirements of the General and Transportation Conformity portions of the Clean Air Act and non-attainment New Source Review requirements. Transportation conformity means that transportation activities, such as planning and building new roads, will not cause new air quality violations, worsen existing violations, or delay timely attainment of the national ambient air quality standards. Non-attainment New Source Review assures that new emissions will not slow progress toward cleaner air.

Once the state recommendations are made, the EPA reviews and considers the merits of each. EPA then makes the final designations after receiving comment and input from affected parties, including the state and local areas. The EPA typically uses the most recent three years of monitoring data to perform a non-attainment calculation test. EPA utilized the 2001 – 2003 data for designation purposes for both ozone and $PM_{2.5}$. Areas that have complete data (3 years of quality assured data suitable for designation purposes), are typically evaluated based on either a county level or Metropolitan Statistical Area (MSA) level test in which a single monitor in a county or in an MSA area showing non-attainment is enough to name the entire county or MSA as being in non-attainment for the pollutant in question.

Loudon County was designated non-attainment for the 8-hour ozone standard because it was determined to be contributing to the area's measured ozone levels that were in excess of the 8-hour standard. The ozone monitor that currently operates in Loudon County started monitoring in March 2004, after the time the data was collected (2001 – 2003) that was used to name the Knoxville area non-attainment for ozone. The data collected since March 2004 is not yet of sufficient quantity to use for designation purposes.

Loudon County was designated non-attainment for $PM_{2.5}$ because it was determined to be contributing to the areas measured $PM_{2.5}$ levels that were in excess of the annual $PM_{2.5}$ standard. The $PM_{2.5}$ monitor that currently operates in Loudon County started monitoring in September 2003. Although the monitor did operate during the 2001 – 2003 timeframe, the data collected during that time does not meet the 3 year requirement to use for designation purposes.

Toxic Release Inventory (TRI)

See Appendix B, Additional Data on Sources of Environmental Pollution, for a discussion of what TRI data is and how to use it. See Appendix B, also, for details on TRI data for Loudon County.

In Loudon County, there are nine companies that report TRI data to EPA. Carbon disulfide is, by far, the largest TRI chemical released into air. In 2002, 2,291,142 pounds of carbon disulfide were released into the air in Loudon County by Viskase Corporation. Hydrochloric acid was the second most TRI chemical released into air, at 280,275 pounds from Viskase and Tate and Lyle combined. For total TRI releases to the environment, Viskase Corp. is the largest emitter in Loudon County, releasing about four times the amount of TRI chemicals as Tate and Lyle, the second largest Loudon County emitter. Malibu Boats ranked third. While IMCO was ranked fourth in total TRI releases, it ranked sixth in total air emissions for Loudon County.

In Tennessee, there are 95 counties. Four of the industries in Loudon County rank in Top 100 TRI chemicals released directly to Tennessee air. Viskase ranked tenth, almost entirely because of their carbon disulfide emissions. Tate and Lyle ranked 28th due in large part to hydrochloric acid emissions. Acupowder, in Greenback, Loudon County, reported mostly copper releases and ranked 57th. Malibu Boats, ranked 68th, only reported emission was styrene.

Additional Data on Sources of Environmental Pollution

While Loudon County has many industries, most pretreat their wastewater and discharge it to the municipal waste water treatment plants, thus precluding exposure of the public to most industrial contaminants in surface or ground water. All public water supplies in Loudon County meet drinking water standards. There is no known public exposure to contaminants from Superfund or other hazardous waste sites. The Tennessee River system has fish advisories along much of its length in East Tennessee due to PCBs. Several small streams have advisories due to pasture run-off. Use of these streams should not present a health hazard, as long as people obey the posting instructions.

Detailed information about Toxic Release Inventory data, wastewater, hazardous waste, and water quality issues is discussed in Appendix B.

Discussion

Air Modeling

The University of Tennessee at Knoxville performed air modeling analysis in 2003 primarily to predict particulate matter concentrations from several sources in the area. The model covered five years of meteorological data. The acetaldehyde modeling was performed to predict maximum annual concentrations and maximum 1-hour concentrations for estimating odor levels due to emissions from Tate and Lyle. After the HAPs monitor had been in place for about six months, APC asked UTK to rerun the model to predict the maximum 24-hour concentration and annual average concentration of acetaldehyde. On March 24, 2004, UTK ran the model again, using only the 1990 year of meteorological data since it predicted the highest of the previous results for five years of modeling. No modeling was performed for other chemicals, nor was modeling performed to determine the risk or likelihood of adverse health effects from hazardous air pollutants.

Modeling is not exact; the model makes predictions based on the modeler's estimate of the numerical value and statistical distribution of variables in the complex mathematical equations used in the model. One of the major variables encountered was the contribution to acetaldehyde concentrations from sources other than Tate and Lyle, such as from vehicular emissions. No one knows the percentage contribution to total acetaldehyde concentrations from Tate and Lyle, exhaust from diesel and gasoline vehicles, and other unknown sources. Another important variable is wind speed and direction.

Meteorological data for Knoxville, as measured at the McGee Tyson Airport, was used as input to the model. This is generally valid for Loudon County; however, the terrain along the Tennessee River at Loudon can influence local wind speeds and direction and introduce uncertainty in the modeling results. Meteorological data collected at the HAPs monitor indicate that wind direction is more variable at the monitor than in Knoxville, with more winds coming from the west and northwest. However, the predominant winds are bimodal, from the southwest and northeast for both the monitor location and Knoxville. Areas to the northeast and southwest would be predicted to receive higher concentrations of acetaldehyde than other areas, such as Tellico Village, on average.

The model was run to predict the worst case. The modeling indicated that the predicted annual concentrations of acetaldehyde at the schools on Roberts Road (Loudon Elementary and Fort Loudon Middle) would be about the same as at the air monitoring station (predicted value 0.7 ppb). The concentrations predicted at the Steekee and Mulberry Street Schools (Steekee Elementary and Loudon High School) would be about three times lower than at the air monitoring station. The locations of these schools are shown on Figure 1. These predictions are based on wind speed and direction data collected at McGee Tyson airport for 1990.

Measured wind roses and modeling results both show that wind directions in East Tennessee are bi-modal with prevailing winds out of the southwest during the day and out of the northeast at night. It is primarily night-time winds that would transport emissions from industries in the Blair Bend Industrial Park toward the schools, while winds during the day will likely transport emissions toward the northeast (Miller 2004). Children are at school around eight hours during the day, so their exposures to HAPs at school are likely to be less than the measurements at the monitor, although it is likely that the annual concentrations of HAPs occurring at the schools in downtown Loudon may be similar to those measured at the air monitoring site. People living in that area of Loudon might experience annual concentration exposures similar to the annual concentration exposures at the monitor, since they would be home at night.

Annual average concentrations of acetaldehyde were predicted to be less than 0.1 ppb in the area of Tellico Village. This area is outside the local terrain influence of the Tennessee River, so there is less uncertainty in the modeling results for this area than for Loudon. Because of prevailing wind directions, the annual average concentrations are highest in the northeast and southwest directions from Tate and Lyle. Winds out of the northwest would be required to transport emissions from Blair Bend Industrial Park to the Tellico Village area. Winds from the northwest (including north north west and west north west) occur approximately 20% of the time each month, with velocities ranging from calm conditions to greater than 15 miles per hour for very short periods, as recorded at the monitor. Modeling (using Knoxville meteorlogical data) predicted that, if winds are coming from the northwest, the maximum 1-hour concentration of acetaldehyde could be as high as 11 ppb in the Tellico Village area. This level of acetaldehyde may be higher than an odor threshold for acetaldehyde (geometric mean of 67 ppb, range 1.5 ppb to 390 ppb) (AIHA 1989).

Exposure Assessment

Exposure Pathways

To determine whether persons have been, are, or are likely to be exposed to contaminants, EEP evaluates the environmental and human components that could lead to human exposure. An exposure pathway contains five elements:

1. a source of contamination (in Loudon, mobile sources, industrial sources, natural sources),
2. contaminant transport through an environmental medium (air),
3. a point of exposure (ambient air),
4. a route of human exposure (breathing), and
5. a receptor population (people living in Loudon County).

An exposure pathway is considered complete if there is evidence that all five of these elements are, have been, or will be present. The primary exposure route for this assessment is inhalation.

Exposure and risk to human populations via the inhalation route involves combining pollutant concentration information with information on the geographic distribution of people in the area. Actual exposure (often called the dose) is defined by the concentration to which the individual is exposed and the duration of exposure. A person's exposure depends on the concentration within a location (microenvironment) and how long a person spends in each microenvironment.

Ambient air monitoring, such as is being done in Loudon with the HAPs monitor, is useful because the data can be applied to a larger population than can be done with personal monitoring. The outdoor fixed-location HAPs monitor has identified the general concentrations and trends in concentrations of HAPs in a specific location; however, estimations of individual exposures cannot be made from one fixed location monitor. As the distance from that location increases, the certainty of how the data applies to other locations decreases. The monitor was placed in an area that is expected to receive the highest concentrations of chemicals from Blair Bend and Sugarlimb Road Industrial Parks, given practical considerations such as site accessibility, availability of electric power, and permission from the property owner for placement of the monitor. Some homes are closer to the industries than the monitor, but most are farther away. Because one monitor is in place, rather than a network of monitors, making judgments about actual exposures of people in other locations is difficult.

In addition, the length of time a person spends at any one location will affect that person's potential exposure. Most people leave home at some point during any 24-hour period, for work, school, shopping, doctor appointments, and such things, so their personal potential exposure cannot be predicted with any accuracy. Assuming that everyone is exposed to concentrations of chemicals measured at the monitor for 24 hours every day is a worst case scenario. Actual exposures are likely to be much less than this.

Environmental Media Evaluation Guides and Screening Levels

Scientists today cannot precisely determine at what level a particular chemical in the environment presents a clear and predictable risk to human health. Sometimes scientists in various government and private agencies disagree on the amount of a chemical necessary to harm a person. At this time, predicting risk from exposure to chemicals in the environment is based on the professional judgments of scientists skilled in toxicology, pharmacology, biochemistry, and other similar disciplines. A collection of studies, opinions, and experiments on chemical exposure makes up what is referred to as the environmental literature. A tool commonly used during environmental public health investigations is a screening level. Screening levels are chemical concentrations based on toxicological investigatons below which no adverse health effects are predicted to occur.

The Agency for Toxic Substances and Disease Registry (ATSDR), affiliated with the Centers for Disease Control and Prevention (CDC), is charged by Congress with providing support in the assessment of any health risk posed by Superfund or other hazardous contaminant releases. For non-carcinogenic effects of toxic chemicals, ATSDR derives a minimal risk level (MRL) for each chemical. From these MRLs, ATSDR has derived health guidance values, often called Environmental Media Evaluation Guides (EMEGs) for soil, air, and water. In this health assessment, EEP used ATSDR's EMEGs for air as a starting place in determining if health hazards may exist in Loudon County, Tennessee, based on the HAPs data.

EMEGs serve as screening guidance to help scientists look more closely at the people who might be exposed. To use these screening levels we must know how much of a chemical someone is exposed to, for how long that exposure has been or will be occurring, how frequent the exposure is or will be, and age of the exposed person. If concentrations are below the EMEG for a particular chemical, scientists can be reasonably certain that no adverse health effects will occur in people who are exposed. If concentrations are above the EMEG for a particular chemical, then the public health implications need to be evaluated further.

EPA is mandated to publish toxicity information that is very similar to ATSDR's MRLs and EMEGs. EPA's reference dose (RfD) and reference concentration (RfC) are analogous to ATSDR's MRL. One difference is that ATSDR must use information that has been published, while EPA may use results of studies that are not published. There are other policy decisions that may result in ATSDR and EPA deriving different MRLs, RfDs and RfCs for the same chemical. In addition, ATSDR derives EMEGs for varying chronic, intermediate, and acute exposure frequencies. Chronic exposure is defined as one year or more. Intermediate exposure is defined as 15 – 364 days. Acute exposure is defined as fourteen days or less. EPA-derived RfDs and RfCs are for chronic or lifetime exposure. If ATSDR does not have a published EMEG for a particular chemical, EEP used EPA's health guidance values. RfDs are used for ingestion exposures, while RfCs are used for inhalation exposures.

If a chemical is a probable or known human carcinogen, EPA derives a cancer risk value for that chemical. EPA uses data from animal studies (and human epidemiology studies, if they are available) to extrapolate from high doses with known carcinogenic end points to very low doses using complex models. Often EPA assumes there is no threshold; that is, any exposure will result in some risk of cancer. This is an assumption that is valid is some cases and not in others, but for most chemicals we lack sufficient data to know the validity of the assumption. EPA then uses one of several models to determine the slope of the 95% upper confidence level of the extrapolated response at low concentrations. This derived slope factor is the number that represents the theoretical risk of excess cancer from exposure to the chemical in question [EPA 1992]. It is important to note that the cancer risk value is a statistically-derived number representing an upper 95% confidence level of a theoretical straight line predicting an extra cancer in one million people, while the background lifetime risk of cancer is about one in two for men and one in three for women (ACS 2005). ATSDR does not publish a comparable guidance value; they use EPA's slope factor. EPA regulates chemicals in the environment when their presence could result in the range of one excess cancer risk in 1,000,000 people to one excess cancer in 10,000 people (EPA 1991).

MRLs and slope factors will change periodically as scientists discover more about how a particular chemical does or does not cause harm to people. The MRLs and slope factors can get higher or lower. Risk assessments (that quantitatively predict adverse health effects at low dose exposures) are based on the best information available at the time of the assessment. A summary of the "do's and don'ts" of using health guidance values follows (DeRosa 2002).

Health guidance values may be properly used as:

1. Screening values to identify substances/chemicals of concern at hazardous waste sites,
2. Substance-specific trigger levels to identify possible need for further investigation of potential exposure scenarios,
3. To identify populations at potential risk,
4. For use in computing other health guidance values (for example, use of oral MRLs for soil ingestion screening levels)

Health guidance values should not be used as:

1. Threshold levels for a toxic effect,
2. Predictors of toxicity at any given level above the health guidance value,
3. Absolute values (since there is an inherent area of uncertainty surrounding them),
4. Screening values for all effects and populations (without first evaluating the relevance of the critical effect upon which the health guidance value was based).

Chemicals of Concern

When a screening level concentration is exceeded, the term, chemical of concern (COC), is often applied. Chemicals of concern require further investigation. When a chemical of concern is identified, it does not immediately indicate that people would be expected to develop adverse health effects. It does mean that the exposure scenario, including exposure potential, dose, duration, and frequency, needs to be thoughtfully considered.

Four of the HAPs, benzene, carbon tetrachloride, acetaldehyde, and formaldehyde, plus carbon disulfide were identified as chemicals of concern that warrant more discussion in this section. Benzene, carbon tetrachloride, acetaldehyde, and formaldehyde were included because they were above screening levels. Carbon disulfide was included as a chemical of concern because the community was concerned about the large volume used by Viskase Corporation. In addition, ozone and particulate matter are discussed because Loudon County is or may be in non-attainment for these air pollutants. No screening levels were available for many of the HAPs. In that case, concentrations were compared to levels found in other locations. If the concentrations of these chemicals were very low and the same as in other locations, then they were not considered for further evaluation.

Exposure Assumptions

The effect of a chemical on the body depends on how much of the chemical is absorbed into the body (dose), how long the exposure(s) lasts (duration), and how often the exposure occurs (frequency). The assumptions used in this public health assessment are that:

- the amount of a specific chemical measured at the HAPs monitor is absorbed into the body,
- exposure lasts for 70 years (chronic exposure), and
- exposure is constant, 24 hours every day.

These are worst case assumptions. No one knows the concentrations of the HAPs at other locations, but the monitor was placed where the highest concentrations were expected. In addition, no one stays at the monitor for a lifetime. Everyone moves around - going to work, school, shopping, vacation, etc.

Acetonitrile Contamination and Corrective Actions

After sampling for air toxics was begun in Loudon, the sampling results reported by the EPA contracted analytical laboratory indicated that extremely high levels of a compound identified as acetonitrile were present. These results caused an investigation to be started to identify the possible source of the chemical. No known industrial sources were identified in the Loudon, Tennessee, area. The possible presence of the compound as a contaminant in exterior caulk was also investigated because a commercial caulk was used in sealing some of the exterior openings on the monitoring site shelter. The caulking material did not contain acetonitrile according to the manufacturer. The laboratory was requested to assist in determining the cause of the elevated acetonitrile measurements.

The laboratory reported that a similar problem had occurred at a monitoring site operated by Rutgers University and was traced to contamination in the canister side (captures volatile organic compounds) of the combined canister/cartridge sampling system caused by back gassing of acetonitrile from the carbonyl cartridge sampling tubes (captures aldehydes and acetone) into the internal tubing and back into the canister sampling side of the air toxics monitor during pre-sampling automated purging. The acetonitrile may have also been leaking through a defective solenoid check valve and into the canister sampling side of the monitor. Acetonitrile is used in the preparation of the carbonyl (aldehydes and acetone) cartridge sampling tubes and residual levels are present on the unexposed sampling cartridges installed in the monitor. The results of the investigation identified the source of the acetonitrile to be from the actual carbonyl cartridges used in routine sampling activities.

The solution to correct the acetonitrile contamination problem offered by the air toxics monitor manufacturer and the laboratory was to split the combined air toxics sampling system into two separate systems (one for canister samples and the other for the cartridge samples) and to clean or replace the sample lines that may be contaminated by the acetonitrile and to replace the solenoid valve suspected of leaking. Additionally, two separate sample inlet manifolds were installed to completely separate the two sampling system components. Additional corrective measures included replacing the mass flow controllers that were also suspected of becoming significantly contaminated and were not able to be cleaned in an adequate manner. The manufacturer, with the approval of the laboratory, performed all modifications to the air toxics monitors.

These corrective modifications were undertaken as a deliberate action to correct the erroneous acetonitrile measurements. These actions were effective in lowering acetonitrile contamination in the canister samples. All of the three air toxics monitors used by the State for air toxics sampling underwent the above described modifications because of elevated acetonitrile levels observed in the canister samples.

The acetonitrile measurements made prior to the completion of the modifications to the air toxics monitoring equipment are suspect due to the contamination of the sampling system by this compound. Any ambient levels of acetonitrile that may be present would be masked by the much higher levels of acetonitrile contamination present.

Concentrations of Acetaldehyde and Formaldehyde Before and After Corrective Actions

Concentrations of all the aldehydes decreased after the corrective actions described above were taken. The most noticeable of these were the concentrations of formaldehyde, acetaldehyde, and hexaldehyde. The Division of Air Pollution Control has endeavored to find the cause for the higher measurements observed from November 2003 through April 9, 2004 and why the levels dropped after April 9, 2004. At this time they have not been able to identify the reasons. The levels have remained low and have not returned to the pre-April 2004 levels. Although the data for aldehydes measured up to April 9 cannot be invalidated, it is suspect and should not be used for decision making purposes.

Hazardous Air Pollutants (HAPs) and Criteria Air Pollutants

Air toxics monitoring for Loudon began in November 2003. Chemicals of concern, as well as ozone and particulate matter, will be discussed in detail in this section. See Table 5 for basic information on concentrations of the chemicals of concern. A description is provided in Appendix C of each HAP not identified as a chemical of concern. Appendix C provides information related to the HAP's toxicity, target organs, and concentrations found in ambient air in other locations. The HAPs were selected by EPA and were analyzed by the EPA-contract laboratory, Environmental Research Group, which is set up to routinely run analysis for these compounds. In addition, the criteria air pollutants ozone and $PM_{2.5}$ are discussed in this section.

Table 5. Concentrations of hazardous air pollutants of concern and carbon disulfide (ppbv), Loudon, Loudon County, Tennessee. November 15, 2003 – December 24, 2005.

HAP	Minimum	Maximum	Mean	Screening levels [1]
Benzene	0.15	1.11	0.38	0.04 – 4 ppb
Carbon tetrachloride	0.06	0.14	0.09	0.01 ppb
Acetaldehyde	0.32	4.71	1.79 (1.24 after 4/18/04)	0.3 – 36 ppb
Formaldehyde	0.38	40	7.58 (2.02 after 4/18/04)	0.065 – 81 ppb
Carbon disulfide	0.3	96.3	8.5	300 ppb

[1] See discussions of each chemical

Acetaldehyde

Acetaldehyde occurs as a volatile, flammable, colorless liquid. It has a pungent, suffocating odor, but at dilute concentrations it emits a pleasant, fruity odor. It is a highly reactive compound that undergoes numerous chemical reactions. Acetaldehyde is a product of alcohol fermentation and a metabolic intermediate in higher plants. It is found in cigarette smoke, as a component from burning wood and fossil fuels and occurs in gasoline and diesel exhaust. An estimated total annual emission from residential burning in the United States is approximately 99 million pounds. It naturally occurs as emissions from forest fires, volcanoes, and animal wastes (NTP 2002). By far, the principal source of exposure to acetaldehyde for the majority of the general population is through the metabolism of alcohol (WHO 1995).

The U.S. Department of Health and Human Services (DHSS), National Toxicology Program (NTP) has classified acetaldehyde as reasonably anticipated to be a human carcinogen based on sufficient evidence of carcinogenicity in experimental animals (NTP 2002). EPA considers acetaldehyde a B2, probable human carcinogen because there is evidence of carcinogenicity in animals, but insufficient evidence in humans (IRIS). The International Agency for Research on Cancer (IARC) considers acetaldehyde a probable human carcinogen, Group 2B. When test rats and hamsters were forced to breathe acetaldehyde, it increased the incidence of squamous cell carcinomas and adenocarcinomas in the nasal mucosa in rats of both sexes and laryngeal carcinomas in hamsters of both sexes. In another inhalation study using a lower exposure level and in an intratracheal instillation study, however, researchers observed no increased incidence of tumors in hamsters. Other experiments in hamsters found that breathing acetaldehyde increased the incidence of respiratory tract tumors that were induced by intratracheal instillation of benzo[*a*]pyrene (a known human carcinogen used in animal experiments to measure the ability of other chemicals to promote cancer) (NTP 2002).

While animal studies suggest exposure to acetaldehyde increases cancer risk under some conditions, there is inadequate evidence of carcinogenicity in humans. A single study of workers in an acetaldehyde plant reported nine cases of cancer, including five cases of bronchial tumors and two cases of carcinomas of the oral cavity. This study was considered to be inadequate for evaluation, however, because of mixed exposure, the small number of cases, and the poorly defined population. Three case control studies investigated the risk of oral, throat, and esophageal cancers following heavy alcohol intake. These studies consistently showed an increased risk of these cancers in people with genetic polymorphisms that resulted in higher blood acetaldehyde concentrations after drinking alcohol (NTP 2002). The lack of a clear trend across studies, however, makes it difficult to draw a conclusion about the role of acetaldehyde as a human carcinogen.

Human exposure recommendations vary across regulatory organizations. For example, EPA has derived an RfC for acetaldehyde of 9 $\mu g/m^3$ or 5 ppb. This level is expected to be safe for a lifetime exposure to acetaldehyde, not considering carcinogenic effects [IRIS]. EPA has developed an inhalation unit risk of 2.2 excess cancers for each microgram per cubic meter ($\mu g/m^3$) of acetaldehyde exposure. Table 6 describes the theoretical excess cancer risk for concentrations in air in units of $\mu g/m^3$ and in units of ppb.

Table 6. Risk of excess cancer for different concentrations of acetaldehyde in air using EPA data

Risk Level	Concentration $\mu g/m^3$	Concentration ppbv
1 in 10,000	50	30
1 in 100,000	5	3
1 in 1,000,000	0.5	0.3

The World Health Organization (WHO) has used two approaches to provide guidance about putative cancer risks associated with acetaldehyde. The first approach assumes that there is a threshold below which no cancers will form. They call the result of this approach a tolerable concentration based a no adverse effect level in rodents divided by a safety factor. The second approach assumes there is no threshold and uses a linear extrapolation in the same way that EPA does. The tolerable concentration is 0.3 mg/m^3 (167 ppb). The range of concentrations associated with an excess lifetime risk of 1 extra cancer in 100,000 people are 11 to 65 $\mu g/m^3$ (6 to 36 ppb) (WHO 1995).

EPA has released a summary report for all their HAPs monitoring sites for 2003 and 2004. Five measurements from Loudon County are included in the report. Some of the sites chosen for HAPs monitors were chosen because of industrial sources, while other sites were chosen to represent normal background levels, without industrial contributions. Data for all HAPs monitoring sites, normal background monitoring sites, and Loudon County are summarized in Table 7 (EPA 2005, TDEC 2006).

Table 7. Summary acetaldehyde concentrations measured at HAPs monitors in all fifty states plus District of Columbia, Puerto Rico, and the U. S. Virgin Islands, 2003 – 2004, and Loudon County, 2003 - 2005.

	Concentrations		No. of observations
	ppbC [1]	ppbV	
Annual average all data 2003	2.87	1.43	11,745
Annual average all data 2004	2.62	1.31	10,025
Annual average background 2003	3.50	1.75	[NY] 1,037
Annual average background 2004	2.67	1.34	[NY] 813
Average Loudon County all data	NA	1.62	71
Average Loudon County, on or before April 9, 2004	NA	2.89	14
Average Loudon County, after April 9, 2004	NA	1.24	58

[1] ppbC is parts per billion based on the number of carbon atoms; ppbv is parts per billion based on volume. To convert, divide the ppbC by the number of carbon atoms; for acetaldehyde divide by 2 to obtain ppbV. Throughout this document when concentrations are given in ppb, they are in ppbV.
[NY] Many measurements from a Queens County, New York monitor.

The concentrations of acetaldehyde found at the HAPs monitor range from 0.37 ppb to 4.71 ppb, with a mean of 1.62 ppb November 15, 2003 through December 24, 2005. After April 9, 2004, concentrations of acetaldehyde measured at the HAPs monitor (cartridge) dropped. The mean concentrations before and after April 9 are 2.89 ppb and 1.24 ppb, respectively. No one knows the reason for the drop in measured concentrations.

Using EPA's current unit risk for carcinogenic effects, the mean concentration of acetaldehyde at the HAPs monitor could theoretically result in 6 excess cancers in one million people; this risk from exposure to acetaldehyde is based on the assumption that a person is continually at the monitor for 70 years. At EPA's request in 2003, the Science Advisory Board at EPA began a peer review of the acetaldehyde mode-of-action model risk assessment. This review could change the unit risk estimates. EEP cannot make any predictions on the outcome of the review. The completion of the reassessment and its web posting is scheduled for September 30, 2006.

The concentrations of acetaldehyde measured at the HAPs monitor are similar to concentrations found in areas of background measurement for acetaldehyde and are not likely to have adverse public health implications. In addition, EEP did not observe an increase in nasal, laryngeal, or related cancers, which may be related to exposure to acetaldehyde, among Loudon County residents when compared to the state or Franklin County. See the section, Health Outcome Data, beginning on page 34, for a detailed discussion of this.

Formaldehyde

Formaldehyde is a colorless, flammable gas at room temperature. It has a pungent, distinct odor and may cause a burning sensation to the eyes, nose, and lungs at high concentrations. Formaldehyde can react with many other chemicals, and it will break down into methanol (wood alcohol) and carbon monoxide at very high temperatures. Formaldehyde is naturally produced in very small amounts in our bodies as a part of our normal, everyday metabolism.

A major source of formaldehyde is smog in the lower atmosphere. Automobile exhaust from cars without catalytic converters or those using oxygenated gasoline also contain formaldehyde. Formaldehyde is produced by cigarettes and other tobacco products, gas cookers, and open fireplaces. Formaldehyde is found in many products, such as some cheeses, dried foods, fish, antiseptics, medicines, cosmetics, dish-washing liquids, fabric softeners, shoe-care agents, carpet cleaners, glues and adhesives, lacquers, paper, plastics, and some types of wood products. Formaldehyde is given off as a gas from manufactured wood products. A major source of formaldehyde in urban air is incomplete combustion of hydrocarbon fuels (HSDB).

The toxic effects of formaldehyde occur in the nose and pharynx, rather than at more distant respiratory sites. The available weight of evidence indicates that distant site effects from formaldehyde may occur only when the nasal mucosal barrier and the detoxifying metabolism capacity for local disposition of formaldehyde are exceeded (ATSDR 1999).

More than 40 epidemiology studies have looked at the potential for occupational formaldehyde exposure to induce cancer. The interpretation of these studies has provided only equivocal evidence of a relationship between formaldehyde and nasopharyngeal cancer in humans. The evidence for a link between formaldehyde exposure and cancers other than respiratory cancers is even less convincing.

To complicate matters further, researchers have arrived at different conclusions when they analyze the results of individual epidemiologic studies and meta-analyses of many studies. The EPA considers formaldehyde to be a B1, probable human carcinogen. The NPT within DHHS notes that formaldehyde is reasonably anticipated to be a human carcinogen. The International Agency for Research on Cancer (IARC) concluded that there is a causal relationship between exposure to formaldehyde and nasopharyngeal cancer, placing formaldehyde in Group 1. IARC's overall evaluation that formaldehyde is carcinogenic to humans was based on limited evidence in humans and sufficient evidence in experimental animals. In a collaborative review and evaluation of formaldehyde epidemiologic studies, EPA and the Chemical Industry Institute of Toxicology concluded that a weak association between nasopharyngeal cancer and formaldehyde exposure cannot be completely ruled out. Other reputable reviewers have concluded that the causal criteria have not been satisfied.

Occupational and residential exposure to formaldehyde has been associated with reports of symptoms of eye, nose, and throat irritation from exposure to airborne formaldehyde. Studies of volunteers exposed to airborne formaldehyde for short periods of time (8 hours or less) indicate that eye, nose, and throat irritation occurs at concentrations in the range of 400 to 3,000 ppb. Several cross-sectional studies of nasal epithelial tissue specimens from workers exposed to airborne formaldehyde in the approximate average concentration range of 200–1,000 ppb found evidence in some of the workers for mild lesions (stratified squamous epithelium and mild dysplasia) that are indicative of the irritant and reactive properties of formaldehyde. Formaldehyde is very reactive and most, if not all, cells metabolize formaldehyde very quickly (ATSDR 1999a).

While there are many studies of adults occupationally exposed to formaldehyde and exposed under acute controlled conditions, data regarding the toxicological properties of formaldehyde in children are limited. Two studies provide suggestive evidence that children may be more sensitive than adults to the irritant properties of airborne formaldehyde. However, additional research is necessary to confirm or discard the hypothesis that children may be more susceptible than adults to the irritant effects of formaldehyde and to understand the mechanistic basis of this possible difference. Nevertheless, the same types of effects that occur in adults are expected to occur in children (e.g., damage in portal-of-entry tissues at exposure levels that exceed tissue detoxification mechanisms). Symptoms expected to occur in children include eye, nose, and throat irritation from exposure to airborne concentrations between 400 and 3,000 ppb. Given the water-soluble and reactive nature of formaldehyde and the apparent ubiquity of rapid cellular metabolism of formaldehyde, it is expected that the irritant effects of formaldehyde would be restricted in children, as in adults, to portals-of-entry, although no information was located comparing rates of formaldehyde metabolism in children's tissues with rates in adult tissues, either in humans or animals. The developing fetus or nursing infant would be expected to be protected from exposure to formaldehyde by the pregnant or breast-feeding mother. Studies of animals exposed during pregnancy to formaldehyde in air, in the diet or by gavage, or on the skin have found no distinct or consistent effects on fetal development, even at exposure levels that produced severe maternal toxicity (ATSDR 1999a).

ATSDR has derived a Minimal Risk Level (MRL) of 8 ppb for chronic-duration inhalation exposure (365 days or more) to formaldehyde. The MRL is based on a minimal lowest observed adverse effect level (LOAEL) of 240 ppb for histological changes in nasal tissue specimens from a group of 70 workers employed for an average 10.4 years (range 1–36 years) in a chemical plant that produced formaldehyde and formaldehyde resins for impregnating paper. The MRL was derived by dividing the LOAEL by an uncertainty factor of 30 (3 for the use of a minimal LOAEL and 10 for human variability).

EPA has established a quantitative estimate of carcinogenic risk from inhalation exposure, called the Inhalation Unit Risk, of 1.3 x 10^{-5} per $\mu g/m^3$. This means that 1 excess cancer may occur in one million people exposed to 0.07 ppb formaldehyde for a lifetime. Table 8 describes the risk for concentrations in air in units of $\mu g/m^3$ and in units of ppb (IRIS). In 2004 EPA requested its Scientific Advisory Board (SAB) to conduct a peer review of the Formaldehyde Toxicological Review document. The EPA SAB plans to wait on and use findings from an updated National Cancer Institute study of workers in industrial facilities before finalizing its review (EPA 2004a,b). It is likely that this review will result in changes in the extrapolated unit risk value, however, the magnitude and direction of the anticipated change is unknown at this time.

Table 8. Risk of excess cancer for different concentrations of formaldehyde in air

Risk Level	Concentration, $\mu g/m^3$	Concentration, ppbv
1 in 10,000	8.0	6.5
1 in 100,000	0.8	0.65
1 in 1,000,000	0.08	0.065

The WHO reports that formaldehyde is only carcinogenic at doses that cause cell damage in the nose and pharynx. The WHO has set its guideline for formaldehyde in ambient air at 0.1 mg/m^3

(81 ppb). This guideline value represents an exposure level at which there is a negligible risk of upper respiratory tract cancer in humans (WHO 2000).

EPA has released a summary report for all their HAPs monitoring sites for 2003 and 2004. Five measurements from Loudon County are included in the report. Some of the sites chosen for HAPs monitors were chosen because of industrial sources, while other sites were chosen to represent normal background levels, without industrial contributions. Data for all HAPs monitoring sites, normal background monitoring sites, and Loudon County are summarized in Table 9 (EPA 2005, TDEC 2006).

Table 9. Summary formaldehyde concentrations measured at HAPs monitors in all fifty states plus District of Columbia, Puerto Rico, and the U. S. Virgin Islands. 2003 – 2004, and Loudon County, 2003 - 2005.

	Concentrations		No. of observations
	ppbC [1]	ppbV	
Annual average all data 2003	3.49	3.49	[c] 17,807
Annual average all data 2004	3.39	3.39	[c] 18,478
Annual average background 2003	3.14	3.14	[NY] 972
Annual average background 2004	2.20	2.20	[NY] 786
Average Loudon County all data	NA	6.11	71
Average Loudon County, on or before April 9, 2004	NA	19.83	14
Average Loudon County, after April 9, 2004	NA	2.02	58

[1] ppbC is parts per billion based on the number of carbon atoms; ppbv is parts per billion based on volume. To convert, divide the ppbC by the number carbon atoms; for formaldehyde divide by 1 to ppbV. Throughout this document when concentrations are given in ppb, they are in ppbV.
[c] Many measurments from a Chicago, Illinois monitor
[NY] Many measurement from a Queens County, New York monitor

ATSDR's chronic EMEG for non-cancer effects of air exposure to formaldehyde is 8 ppb, higher than the mean concentration found from November 15, 2003, through April 9, 2004, but less than the mean concentration found from April 21, 2004 through December 24, 2005. There is no explanation for the large discrepancy in concentrations measured in the two time periods, but the data for formaldehyde measured until April 9, 2004, is in doubt.

Using the current EPA unit risk value of 1.3×10^{-5} risk per $\mu g/m^3$ and the data from April 18 through December 24, 2005, this could theoretically result in an extra 3 nasopharyngeal cancers in 100,000 people. Using the WHO guideline of 81 ppb, no additional cancers would be expected. The rate of nasopharyngeal cancers in Loudon is not significantly different from Tennessee or Franklin County, but the frequencies are extremely low, causing any statistical tests to be unreliable. Actual rates cannot be reported because the Tennessee Cancer Registry does not allow rates to be published if the number of reported cases is less than 6. See the section, Health Outcome Data, beginning on page 34, for a detailed discussion of this.

Benzene

Benzene is a colorless liquid with a sweet odor. Benzene evaporates into air very quickly and dissolves slightly in water. Benzene is highly flammable. Most people can begin to smell benzene in air at 1,500-4,700 parts of benzene per billion parts of air (ppb). Benzene found in the environment is from both human activities and natural processes. Various industries use benzene to make other chemicals, and it is also used for the manufacturing of some types of rubbers, lubricants, dyes, detergents, drugs, and pesticides. Natural sources of benzene, which include volcanoes and forest fires, also contribute to the presence of benzene in the environment. Benzene is a part of crude oil, gasoline, and cigarette smoke (ATSDR 1997). The major sources of benzene exposure are tobacco smoke, automobile service stations, exhaust from motor vehicles, and industrial emissions.

Epidemiological studies on persons exposed to various levels of benzene in the workplace for intermediate and chronic periods of time indicate hematological effects from benzene exposure. These studies generally have limitations, such as concomitant exposure to other chemicals and lack of appropriate control groups. In addition, a lack of adequate exposure data precludes a qualitative determination of the relationship between severity of effects and exposure levels. However, sufficient data are available to show that the hematopoietic system is a major target for benzene toxicity.

Human studies show that inhalation exposure to benzene for several months to several years can result in pancytopenia or other deficits in the relative numbers of circulating blood cells. Pancytopenia is the reduction in the number of all three major types of blood cells: erythrocytes (red blood cells), thrombocytes (platelets), and leukocytes (white blood cells). In adults, all three major types of blood cells are produced in the red bone marrow of the vertebrae, sternum, ribs, and pelvis. The bone marrow contains immature cells, known as multipotent myeloid stem cells, that later differentiate into the various mature blood cells. Pancytopenia results from a reduction in the ability of the bone marrow to produce adequate numbers of these mature blood cells.

Continued exposure to benzene can also result in aplastic anemia or leukemia. Aplastic anemia is a more severe effect of benzene and occurs when the bone marrow ceases to function and the stem cells never reach maturity. Depression in bone marrow function occurs in two stages-hyperplasia (increased synthesis of blood cell elements), followed by hypoplasia (decreased synthesis). As the disease progresses, bone marrow function decreases and the bone marrow becomes necrotic and filled with fatty tissue. This myeloblastic dysplasia without acute leukemia has been seen in persons exposed to benzene. Aplastic anemia can progress to a type of leukemia known as acute myelogenous leukemia (AML).

Immunological effects have been reported in humans with occupational exposure to benzene. There are two types of acquired immunity, humoral and cellular, and benzene damages both. First, benzene has been shown to alter humoral immunity (i.e., to produce changes in levels of antibodies in the blood). The second type of immunity, cellular immunity, is affected by changes in circulating leukocytes and a subcategory of leukocytes, called lymphocytes. Leukopenia was found in a series of studies of workers exposed to benzene in air at levels ranging from 15,000 to 210,000 ppb in various manufacturing processes in Turkey.

The NPT has assigned benzene as a known human carcinogen; the EPA considers benzene a known human carcinogen, class A; IARC has placed benzene in Group 1, carcinogenic to humans. Case reports and epidemiological studies of workers have established a causal relationship between benzene exposure and acute myelocytic (or myeloid) leukemia (AML).

While some studies implicate other types of leukemia or even lymphomas, only the incidence of AML and its variants has consistently been increased in groups of workers with excess benzene exposure.

Each of the studies has deficiencies that affect their quality and interpretation. A cause-effect relationship between benzene and AML is sufficiently clear; however, there are few data from which dose-response relationships can be established. Airborne concentrations of benzene in the workplaces studied in epidemiologic studies ranged from about 10,000 to 500,000 parts per billion (ppb), many times higher than the concentrations of benzene detected at the HAPs monitor in Loudon County (average of 0.39 ppb as of May 22, 2005).

An epidemiological study of employees at a Texas refinery showed no leukemia deaths following benzene exposures to airborne concentrations less than 1,000 ppb. The median benzene exposures were 140 ppb for refinery workers and 530 ppb for those in benzene-related units. Within this cohort, the relative risk for all cancer was not significant as compared to case referents or to the general population of the United States. Furthermore, the evaluation of medical records of this cohort showed no significant changes in blood indices (leukocyte, erythrocyte, hemoglobin, hematocrit, platelet, clotting and bleeding time in minutes).

Data from studies of workers exposed to benzene suggest that humans exposed to benzene in the occupational setting for acute, intermediate, or chronic durations by the inhalation and oral routes are at risk of developing neurological effects.

Epidemiological studies implicating benzene as a developmental toxicant have many limitations, and thus it is not possible to assess the effect of benzene on the human fetus. Results of inhalation studies conducted in animals are fairly consistent across species and demonstrate that, at levels greater than or equal to 47,000 ppb, benzene is fetotoxic.

The occurrence of aplastic anemia in chronic benzene toxicity may be accelerated in individuals with viral hepatitis. Furthermore, children and fetuses may be at increased risk-because their hematopoietic cell populations are expanding and dividing cells are at a greater risk than quiescent cells.

ATSDR has derived a Minimal Risk Level (MRL) of 4 ppb for intermediate-duration inhalation exposure (15-365 days) to benzene. There were no studies appropriate for the derivation of an MRL for chronic-duration inhalation exposure.

At present, the true cancer risk from exposure to benzene cannot be ascertained, even though dose-response data are used in EPA's quantitative cancer risk analysis, because of uncertainties in extrapolating to the low-doses found in environmental exposures and lack of clear understanding of the mode of action. EPA suggested using a range of risk estimates, each having equal scientific plausibility. The range estimates are maximum likelihood values (i.e., best statistical estimates) and were derived from observable dose responses using a linear extrapolation model to estimate low environmental exposure risks [IRIS]. EPA has established a risk range for developing cancer from inhalation exposure to benzene: 2.2×10^{-6} to 7.8×10^{-6} excess risk of cancer from exposure to 1 ug/m^3 of benzene for a lifetime. This means that there may be one excess cancer in a million people exposed to 0.04 to 0.14 ppb of benzene over a lifetime. Table 10 describes the risk for various concentrations in air.

The use of a linear model to predict risk at low exposures is a default public health protective approach. Since the mechanisms by which exposure to benzene and its metabolites exert their toxic and carcinogenic effects remain uncertain, EPA found it inappropriate to model the risk estimates using any other shape of dose response curve at low doses of exposure. However, occupational epidemiologic studies suggest that, while inhalation exposures to parts per million levels of benzene (10,000 to 100,000 ppb) are associated with leukemia, exposures to less than 1,000 ppb are not associated with leukemia or other significant changes in blood indices.

Table 10. Risk of excess cancer for different concentrations of benzene in air

Risk Level	Concentration, µg/m^3	Concentration, ppbv
1 in 10,000	13.0-45.0	4-14
1 in 100,000	1.3-4.5	0.4-1.4
1 in 1,000,000	0.13-0.45	0.04-0.14

Table 11 presents summary data on benzene from the EPA HAPs monitoring sites for 2003 and 2004 (EPA 2005, TDEC 2005). Some of the sites chosen for HAPs monitors were chosen because of industrial sources, while other sites were chosen to represent normal background levels, without industrial contributions.

Table 11. Summary benzene concentrations measured at HAPs monitors in all fifty states plus District of Columbia, Puerto Rico, and the U. S. Virgin Islands. 2003 – 2004.

	Concentrations		No. of observations
	ppbC [1]	ppbV	
Annual average all data 2003	2.53	0.421	121,988
Annual average all data 2004	2.43	0.405	125,567
Annual average background 2003	3.14	0.523	[TX] 3,716
Annual average background 2004	2.43	0.406	8,644
Average Loudon County all data	NA	0.38	74

[1] ppbC is parts per billion based on the number of carbon atoms; ppbv is parts per billion based on volume. To convert, divide the ppbC by the number carbon atoms; for benzene divide by 6 to obtain ppbV. Throughout this document when concentrations are given in ppb, they are in ppbV.
[TX] Many measurement from a Port Author, Texas monitor

The mean concentration of benzene measured at the HAPs monitor in Loudon was 0.38 ppb from November 15, 2003 through December 24, 2005. The EPA, the DHHS, and the IARC consider benzene a known human carcinogen. Using EPA's published unit risk range, the mean concentration of benzene could theoretically result in 2.5 to 7 excess cancers in one million people.

The benzene levels, with a maximum of 1.1 ppb, measured at the HAPs monitor, are less than the background levels found elsewhere (2.8 to 20 ppb). It is reasonable to assume that industrial sources near the monitor are not emitting large concentrations of benzene. Because major sources of benzene in ambient air are exhaust from motor vehicles and from consumer products, EEP cannot determine if the benzene concentrations measured at the HAPs monitor are indicative of benzene concentrations in other areas of the county.

The rate of acute myeloid leukemia (associated with benzene exposure) is not elevated in Loudon County, using all available data. It is likely that there are no public health implications from benzene measured at the HAPs monitor. See the section, Health Outcome Data, beginning on page 34, for a detailed discussion of this.

Carbon Disulfide

Pure carbon disulfide is a colorless liquid with a pleasant odor that smells sweet. The impure carbon disulfide that is usually used in most industrial processes, however, is a yellowish liquid with an unpleasant odor like that of rotting radishes. Since carbon disulfide evaporates at room temperature, its major route of exposure is inhalation. Carbon disulfide is a major fugitive and point source emission of Viskase Corporation. Viskase has plans in place to meet the new Maximum Available Control Technology (MACT) to lower its releases of carbon disulfide.

The ATSDR chronic EMEG for carbon disulfide in air is 300 parts per billion (ppb). The MRL underlying the EMEG is based on the lowest observed adverse effect level (LOAEL) from occupational exposures, with an uncertainty factor of 30. The LOAEL is based on minimal toxicity resulting in decreased maximum motor conduction velocity of the peroneal nerve and sensory nerve conduction velocity of the sural nerve. The decreased velocities were still within the normal range (ATSDR 1996).

Data on chronic occupational exposures to carbon disulfide identify the nervous system as the primary target of inhalation exposure. Most of the occupational studies have limitations concerning the exposure measurements and concomitant exposures to other chemicals; some are limited by the methods used to assess the health effect end points. Additional data concerning the effects of chronic low-level exposure to carbon disulfide following the inhalation, oral, and dermal routes are needed to establish a dose-effect relationship for the major health effects (ATSDR 1996).

While the primary target of carbon disulfide appears to be the nervous system, carbon disulfide may have other effects. Vascular atherosclerotic changes are a primary effect following long-term exposure to carbon disulfide. Epidemiologic studies have established a relationship between occupational exposure to carbon disulfide and increased mortality due to coronary heart disease. Because coronary heart disease has a multicausal origin that is influenced by saturated fat intake, smoking, diabetes, and physical inactivity, carbon disulfide may be a cofactor in the presence of these other risk factors. In addition, workers in the studies were exposed to other chemicals (ATSDR 1996).

The Environmental Defense Fund (EDF) has listed carbon disulfide as both a reproductive and developmental toxin. EDF classifies chemicals based on the current list of chemicals developed by the State of California under Proposition 65. A short-coming with EDF's classification system is that they have not provided an easily found discussion of the scientific evidence used in the classifications.

Studies of occupational cohorts exposed to carbon disulfide via inhalation have provided most of the data on reproductive effects of carbon disulfide. These studies are limited by generally poor exposure measurements, concomitant exposure to other chemicals, and, sometimes, lack of control groups. Nonetheless, the data indicate that chronic exposure to carbon disulfide can affect the reproductive system in both males and females. In males, sperm morphology, hormone levels, and libido have been altered by occupational exposure to carbon disulfide. In human females, menstrual irregularities have been associated with inhalation exposure to carbon disulfide, although more serious effects such as increased miscarriage and reduced fertility have not been universally noted. These effects occurred at higher concentrations than did the neurological effects (ATSDR 1996).

Developmental effects of carbon disulfide have been studied in animals; there are no convincing human data that support an increased rate of congenital malformation in children born to mothers exposed by any route to carbon disulfide. Some studies were limited by absence of information on exposure conditions. However, in a carefully designed inhalation study in New Zealand White Rabbits, a no observed adverse effect level (NOAEL) was 300,000 parts per billion (ppb). Data on rodents suggest an increased fetotoxicity following inhalation exposure to carbon disulfide. There is evidence that carbon disulfide can cross the placenta and is distributed to the fetal brain blood, liver, and eyes (ATSDR 1996).

EPA has released a summary report for all their HAPs monitoring sites for 2003 and 2004. Five measurements from Loudon County are included in the report. Some of the sites chosen for HAPs monitors were chosen because of industrial sources, while other sites were chosen to represent normal background levels, without industrial contributions. Data for all HAPs monitoring sites, normal background monitoring sites, and Loudon County are summarized in Table 12 (EPA 2005, TDEC 2005).

Table 12. Summary carbon disulfide concentrations measured at HAPs monitors in all fifty states plus District of Columbia, Puerto Rico, and the U. S. Virgin Islands. 2003 – 2004, and Loudon County, 2004 - 2005.

	Concentrations		No. of observations
	ppbC [1]	ppbV	
Annual average all data 2003	0.35	0.35	3,399
Annual average all data 2004	0.40	0.40	2,636
Annual average background 2003	NE	NE	1
Annual average background 2004	NE	NE	2
Average Loudon County all data	NA	14.3	34

[1] ppbC is parts per billion based on the number of carbon atoms; ppbv is parts per billion based on volume. To convert, divide the ppbC by the number carbon atoms; for carbon disulfide divide by 1 to ppbV. Throughout this document when concentrations are given in ppb, they are in ppbV.
NE: not enough background samples were collected to determine an average

The concentrations of carbon disulfide measured at the HAPs monitor range from 0.3 ppb to 96.3 ppb, with an average of 14.3 ppb.

These levels of carbon disulfide are higher than found in other areas of the U.S.A., but are well below the ATSDR chronic EMEG of 300 ppb and are not expected to present a public health hazard. Because carbon disulfide has such a distinctive odor, its presence at these concentrations could present an odor problem.

Carbon Tetrachloride

Carbon tetrachloride is a clear liquid that evaporates very easily. Most carbon tetrachloride that escapes to the environment is therefore found as a gas. Carbon tetrachloride does not easily burn. Carbon tetrachloride has a sweet odor, and most people can begin to smell it in air when the concentration reaches 10,000 parts carbon tetrachloride per billion parts of air (ppb). It is not known whether people can taste it or, if they can, at what level.

Carbon tetrachloride does not occur naturally but has been produced in large quantities to make refrigeration fluid and propellants for aerosol cans. Since many refrigerants and aerosol propellants have been found to affect the earth's ozone layer, the production of these chemicals is being phased out.

Concentrations in air of 0.1 part carbon tetrachloride per billion parts of air (ppb) are common around the world, with somewhat higher levels often found (0.2-0.6 ppb) in cities. Once carbon tetrachloride is in the troposphere, it is a stable gaseous compound. Due to the lack of rapid tropospheric removal mechanisms, carbon tetrachloride accumulates in the lower atmosphere and has an estimated atmospheric lifetime of 50 years. Thus, the most common source of exposure to ambient carbon tetrachloride is from the global background concentration which is not related to any source located in Loudon County (California 1987).

Most information on the health effects of carbon tetrachloride in humans comes from cases where people have been exposed to relatively high levels of carbon tetrachloride, either only once or for a short period of time. Experiments have not been performed on the effects of long-term exposure of humans to low levels of carbon tetrachloride, so the human health effects of such exposures are not known.

The liver is especially sensitive to carbon tetrachloride. In mild cases, the liver becomes swollen and tender, and fat builds up inside the organ. In severe cases, liver cells may be damaged or destroyed, leading to a decrease in liver function. Such effects are usually reversible if exposure is not too high or too long. The kidney is also sensitive to carbon tetrachloride. Less urine may be formed, leading to a buildup of water in the body (especially in the lungs) and buildup of waste products in the blood. Kidney failure often was the main cause of death in people after very high exposure to carbon tetrachloride. Fortunately, if injuries to the liver and kidney are not too severe, these effects disappear after exposure stops. This is because both organs can repair damaged cells and replace dead cells and associated materials. Function usually returns to normal within a few days or weeks after exposure.

After exposure to high levels of carbon tetrachloride, the nervous system, including the brain, is affected. Such exposure can be fatal. The immediate effects are usually signs of intoxication, including headache, dizziness, and sleepiness perhaps accompanied by nausea and vomiting. These effects usually disappear within a day or two after exposure stops. In severe cases, stupor or even coma can result, and permanent damage to nerve cells can occur.

Carbon tetrachloride also causes effects on other tissues of the body, but these are not usually as common or important as the effects on the liver, kidney, and brain. Limited human studies suggest that drinking water exposure to carbon tetrachloride might possibly be related to certain birth defects, low birthweight, and small size at birth. Information from animal studies indicates that carbon tetrachloride does not cause birth defects, but might decrease the survival rate of newborn animals. Many reported cases of carbon tetrachloride toxicity are associated with drinking alcohol. The frequent drinking of alcoholic beverages increases the danger from carbon tetrachloride exposure (ATSDR 1994).

Studies in animals have shown that the ingestion of carbon tetrachloride can increase the frequency of liver tumors in some species. Studies have not been performed to determine if breathing carbon tetrachloride causes tumors in animals, or whether swallowing or breathing carbon tetrachloride causes tumors in humans, but it should be assumed that carbon tetrachloride could produce cancer. The Department of Health and Human Services (DHHS) has determined that carbon tetrachloride may reasonably be anticipated to be a carcinogen. The International Agency for Research on Cancer (IARC) has determined that carbon tetrachloride is possibly carcinogenic to humans. The EPA has determined that carbon tetrachloride is a probable human carcinogen. EPA has derived an Inhalation Unit Risk of an excess risk of cancer of 1.5×10^{-5}. This means that 1 excess cancer in one million people may occur if people are exposed to 0.01 ppb carbon tetrachloride over a lifetime.

Table 13 presents summary data on carbon tetrachloride from the EPA HAPs monitoring sites for 2003 and 2004 (EPA 2005, TDEC 2005). Some of the sites chosen for HAPs monitors were chosen because of industrial sources, while other sites were chosen to represent normal background levels, without industrial contributions.

Table 13. Summary carbon tetrachloride concentrations measured at HAPs monitors in all fifty states plus District of Columbia, Puerto Rico, and the U. S. Virgin Islands. 2003 – 2004.

	Concentrations		No. of observations
	ppbC [1]	ppbV	
Annual average all data 2003	0.09	0.09	[P] 10,985
Annual average all data 2004	0.12	0.12	10,026
Annual average background 2003	NE	NE	
Annual average background 2004	NE	NE	
Average Loudon County all data	NA	0.09	65

[1] ppbC is parts per billion based on the number of carbon atoms; ppbv is parts per billion based on volume. To convert, divide the ppbC by the number carbon atoms; for carbon tetrachloride divide by 1 to obtain ppbV. Throughout this document when concentrations are given in ppb, they are in ppbV.
NE: no general/background air sampling values
[P] Observations include many measurements from a Providence, Rhode Island monitor

The concentrations are above the EPA unit risk of 0.01 ppb, which theoretically could result in one excess cancer in one million people. The EPA unit risk was derived using oral ingestion data in test animals, rather than inhalation data, resulting in a low confidence in the accuracy of the unit risk. However, the concentrations are well below the ATSDR chronic EMEG of 30 ppb; there would be no expected non-cancer adverse effects from breathing 30 ppb of carbon tetrachloride for a lifetime.

It is important to note that there are no data on exposure of humans to low levels of carbon tetrachloride nor is there useful experimental data in animals on adverse effects from inhalation of carbon tetrachloride. Nothing remarkable was noted about liver cancer (associated with carbon tetrachloride exposure in animal studies) in Loudon County compared to Franklin County or Tennessee. It is likely that there are no adverse public health implications from carbon tetrachloride measured at the HAPs monitor. See the section, Health Outcome Data, beginning on page 34, for a detailed discussion of this.

Ozone

An important criteria air pollutant that can threaten health is ground-level ozone. Ozone is a colorless, odorless gas that forms when certain pollutants from cars, trucks, power plants, industrial boilers, and other sources mix and react in the atmosphere, typically during hot, dry summer days. Ground-level ozone is not emitted directly into the air, but is created by chemical reactions between oxides of nitrogen (NOx) and volatile organic compounds (VOCs) in the presence of sunlight. Emissions from industrial facilities and electric utilities, motor vehicle exhaust, gasoline vapors, and chemical solvents are some of the major sources of NOx and VOC.

Ozone can irritate and inflame the passages that carry air from the mouth and nose to the lungs. High ozone levels can cause shortness of breath, coughing, wheezing, chest tightness or pain. Some people are particularly sensitive to ozone. Active children are at highest risk from ozone exposure because they spend a large part of the summer playing outdoors. Children are more likely to have asthma, which may be aggravated by ozone exposure. Active adults and people with respiratory disease are also more vulnerable to the effects of ozone.

The ozone molecule does not penetrate through cell membranes or through the surfactant layer of the lung. Instead a reaction cascade forms chemical intermediates which penetrate cells and cause the observed effects. Inhalation of ozone can affect cells in the alveoli which function to kill bacteria and can affect lung structure resulting in altered function and biochemistry. These effects take place mostly in the deepest areas of the lung (EPA 1996).

Most people only have to worry about ozone exposure when ground-level concentrations reach high levels. In many Tennessee communities, this can happen frequently during the summer months. Table 14 shows the number of air quality alert days forecasted and the number of days that the air quality actually reached alert levels for Knoxville and surrounding areas for 2002-2004 and 2005 through August 9 (preliminary data).

Table 14. Number of air quality alert days forecasted and the number of days that the air actually reached alert levels for Knoxville and surrounding areas 2002-2004 and 2005 (through August 9).

	Forecast	Actual
2002	46	28
2003	7	3
2004	4	2
2005	10 (greater Knoxville area)	4 (Loudon)

The national ambient air quality standard for ozone is 80 ppb, measured as the average of the fourth highest measurement each year for three years. Preliminary data is available for Loudon

County for August 1, 2005, through August 13, 2005. The concentrations of ozone for this period ranged from a low of 30 ppb to a high of 85 ppb. The fourth highest concentration was 83 ppb. Four of the thirteen measurements were above 80 ppb. This is not enough data to predict if Loudon County will be in or out of compliance with the ozone standard.

Particulate Matter

Particle pollution is a mixture of microscopic solids and liquid droplets suspended in air. This pollution, also known as particulate matter, is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, soil or dust particles, and allergens (such as fragments of pollen or mold spores). The size of particles and the composition are directly linked to their potential for causing health problems. Small particles less than 10 micrometers in diameter pose the greatest problems, because they can get deep into the lungs, and some may even get into the bloodstream. Exposure to such particles can affect both the lungs and the heart. Larger particles are of less concern, although they can irritate your eyes, nose, and throat.

People with heart or lung diseases, such as coronary artery disease, congestive heart failure, and asthma or chronic obstructive pulmonary disease (COPD), are at increased risk, because particles can aggravate these diseases. People with diabetes also may be at increased risk, possibly because they are more likely to have underlying cardiovascular disease. Children are likely at increased risk for several reasons. Their lungs are still developing; they spend more time at high activity levels; and they are more likely to have asthma or acute respiratory diseases, which can be aggravated when particle levels are high.

It appears that risk varies throughout a lifetime, generally being higher in early childhood, lower in healthy adolescents and younger adults, and increasing in middle age through old age as the incidence of heart and lung disease and diabetes increases. Factors that increase the risk of heart attack, such as high blood pressure or elevated cholesterol levels, also may increase the risk from particles. In addition, scientists are evaluating new studies that suggest that exposure to high particle levels may also be associated with low birth weight in infants, pre-term deliveries, and possibly fetal and infant deaths (EPA 2004c, Park 2005, Brook 2004).

The region of the state that includes Loudon is out of compliance (non-attainment) with the new ozone and particulate matter ($PM_{2.5}$) standards. Non-attainment is a regional problem, but each county has unique contributions to the problem. For current standards, Loudon County, as well as the region, is in compliance with all air quality standards.

Loudon County has several major roads with heavy traffic, both cars and trucks. Interstate 40 (a major east-west route) merges with Interstate 75 (a major north-south route) in Loudon County. In addition, several state highways connect to Knoxville, Interstates 40 and 75, provide access to Oak Ridge and the regional airport, and connect the area to Atlanta. A bypass is planned for the Knoxville area, which will have impacts on roads used to connect the area with the Great Smoky Mountains. In addition, 15 motor freight carriers are located in Loudon County. Loudon has eleven industries which hold Title V permits or conditional major source permits from the Division of Air Pollution Control (APC) in TDEC. See Figure 1 for a map of the area. Likely, all of these have a role in the predicted ozone and $PM_{2.5}$ levels that may be out of compliance with new standards.

The national ambient air quality standard for $PM_{2.5}$ is 15 $\mu g/m^3$ as an annual average, with a 24-hour maximum of 65 $\mu g/m^3$. In 2003 $PM_{2.5}$ in Loudon County ranged from 5.9 $\mu g/m^3$ to 34.5 $\mu g/m^3$, with an annual average of 15.3 $\mu g/m^3$. In 2004 $PM_{2.5}$ in Loudon County ranged from 5.1 $\mu g/m^3$ to 31.0 $\mu g/m^3$, with an annual average of 12.5 $\mu g/m^3$. Preliminary data for Loudon County in 2005 is available for $PM_{2.5}$ from January 1, 2005, through July 18, 2005. The preliminary data indicates a range of $PM_{2.5}$ from 5.5 $\mu g/m^3$ to 35.7 $\mu g/m^3$.

Mixtures

As indicated by the HAPs monitoring data and other information, Loudon residents are exposed to a mixture of chemicals. However, it is difficult to evaluate the health impact of exposure to chemical mixtures. Most toxicological research focuses on dose responses to single chemicals and not mixtures. Loudon County residents, like other residents of the United States, are also exposed to other sources of air pollutants in their homes and work places. Determination of the impact of the total dose of all sources of air pollutants is beyond the scope and plausibility of this report. However, there is some research on mixtures involving formaldehyde and acetaldehyde.

Several research papers were found addressing the issue of the additivity of health effects from mixtures of formaldehyde and acetaldehyde from inhalation. In the most applicable paper, (Cassee 1996) a measure called the RD50 was used to calculate competition for the trigeminal nerve receptor (site of sensory irritation) of mixtures. The RD50 is a statistically derived concentration which reduces the respiratory rate by 50%. The RD50 for formaldehyde ranges from 4.7 to 13.7 ppm (or 4,700 to 13,700 ppb). When levels of these mixtures are inhaled in the RD50 range, there is competition for the receptor and the total health effect is less than predicted from additivity models. According to the same article, "at concentrations much lower than the RD50, a competition model will result in similar results as predicted by dose-addition of equidoses of each compound." (Cassee 1996). The concentrations of formaldehyde and acetaldehyde ranged from less than 1 ppb to around 3 ppb, respectively, using data since April 9, 2004. These concentrations found in Loudon are well below the RD50. Competition would not be expected for the receptor site. Additive effects would be expected.

In addition to formaldehyde and acetaldehyde, there are other aldehydes and chemicals in the Loudon air that may compete for the trigeminal nerve receptor site. These chemicals are at very low levels, but when mixed together may have a more pronounced health effect. Whether the total effect of the mixture is truly additive or competitive cannot be predicted, but the effect may be greater than effects from any individual HAP.

Health Outcome Data

Methods

In order to analyze health outcome data in a meaningful way, EEP selected a comparison county. Counties considered for selection included peer counties identified by the Community Health

Status Indicators (CHSI) Project, sponsored by the Health Resources and Services Administration (HRSA) (HRSA 2000a). The Community Health Status Reports for this project list Franklin, Coffee, Jefferson, and Loudon Counties as peer counties; EEP believes that Franklin County is the best match for Loudon County for this project (HRSA 2000b,c) because Franklin and Loudon Counties have a similar demographic compositions, but differ with respect to the number of industries with HAPs' emissions. Table 15 presents basic population data comparing the two counties. Table 16 presents data giving an overview of the health status of Loudon and Franklin Counties (HRSA 2000b,c). Franklin County is similar to Loudon County in terms of population size, income, age distribution, and population density. In addition, EEP compared health statistics for Loudon County to Tennessee as a whole.

Table 15. Demographic information comparing Loudon and Franklin Counties in Tennessee. (HRSA 2000b,c.)

	Loudon County	Franklin County
Population	38,234	37,146
Population density (people per square mile)	167	67
Individuals living below poverty level	11.9%	13.3%
Age distribution		
Under age 18	22.9%	24.0%
Age 65-84	13.2%	12.8%
Age 85+	1.4%	1.5%
Nonwhite population		
Black	1.4%	6.6%
American Indian	0.2%	0.2%
Asian/Pacific Islander	0.2%	0.3%
Hispanic origin	0.5%	0.8%

Table 16. Summary measures of health comparing Loudon and Franklin counties. (HRSA 2000b,c).

	Loudon County	Franklin County
Average life expectancy	74.4 years	75.5 years
All causes of death	1,004.4 deaths/100,000 [1]	995.8 deaths/100,000
Low birth weight (<2500 g)	7.8%	7.6%
Infant mortality	9.1/1000 live births	9.5/1000 live births

[1] *Data from the National Center for Health Statistics; age-adjusted to U.S. 2000 standard population*

Initially, EEP reviewed health statistics data found on the Department of Health, Health Information Tennessee (HIT) site (http://www.tennessee.gov/health) for the years 1990 through 2002 to compare the top 10 causes of death between Loudon and Franklin Counties and all of Tennessee (Death Statistics). This data consists of rates adjusted to the age distribution of the 2000 U.S. standard population using direct methods and are given per 100,000 population. The Tennessee population projections used by the Tennessee Department of Health for rate calculations were prepared by the University of Tennessee using direct methods. While this methodology results in more accurate projections than those obtained through the indirect methods employed by the US Census Bureau, use of these projections will give slightly different disease rates. Such rates, however, more readily consider regional circumstances. In addition, coding for the various causes of death presented at the HIT site, excludes some conditions that may be of interest in this particular assessment and should be noted:

- The codes for diseases of the heart exclude hypertension;
- The codes for cerebrovascular diseases exclude diseases of the arteries, arterioles, and capillaries;
- The codes for chronic lower respiratory diseases exclude acute upper respiratory infections, respiratory conditions due to external agents (such as asbestosis), and pulmonary and pleural diseases.

To determine if the rates for the leading causes of death in Loudon County significantly differ from Franklin County and Tennessee, EEP completed two-sample, one-tailed and two-tailed t-tests in SAS (a statistical analysis system) using the data on HIT and six different hypotheses for testing. For these evaluations, EEP defined statistical significance as a p-value of 0.05 or less. The six hypotheses are detailed below.

1. Loudon County age-adjusted rate is significantly different from that of Franklin County (two-tailed t-test)
2. Loudon County age-adjusted rate is significantly higher that of Franklin County (one-tailed t-test)
3. Loudon County age-adjusted rate is significantly lower that of Franklin County (one-tailed t-test)
4. Loudon County age-adjusted rate is significantly different from that of Tennessee (two-tailed t-test)
5. Loudon County age-adjusted rate is significantly higher that of Tennessee (one-tailed t-test)
6. Loudon County age-adjusted rate is significantly lower that of Tennessee (one-tailed t-test)

In order to more thoroughly understand disease trends with respect to community concerns about cancer, respiratory and heart-related illnesses, additional analyses were performed for the 40 specific diseases listed in Appendix D. Data available about these diseases includes:

1. death certificate information from 1990 through 2003 (Death Statistics);
2. inpatient hospital discharge data from 1997 through 2003 (Hospital Discharge 2003a);
3. outpatient hospital discharge data from 1998 through 2003 with 2003 data being provisional (Hospital Discharge 2003b); and
4. Tennessee Cancer Registry (TCR) incidence case data from 1991 through 2000 (Cancer Registry).

Although available, outpatient hospital discharge data from 1997 was excluded because only one of two hospitals in Franklin County provided data for that year. It is also important to note that prior to 2000, hospitals reported emergency room visits and out-patient ambulatory surgeries, but only reported 23-hour observations at their discretion. Finally, hospital discharge data does not include information about disease incidence observed outside of the hospital setting such as non-hospital clinics and private physician offices.

For evaluation purposes, the underlying cause of death for each death record was determined. Likewise, the primary cancer site among cancer incidence cases provided by the TCR was identified. With respect to hospital visits, visits by Tennessee residents to all hospitals in the state of Tennessee were considered for analysis. Since it is possible for a hospital patient to be seen multiple times in one year and to be diagnosed with the same condition more than once, management of hospital records prior to analysis was necessary. In order to determine annual hospitalization prevalence for residents of Loudon County, Franklin County, and Tennessee as accurately as possible, duplicate patients were identified by isolating records with identical demographic information by year. The patient's hospital record number, scrambled social security number, date of birth, race, sex, and county of residence were taken into account for this purpose.

In addition, a patient may have up to nine diagnoses for each hospital visit. All nine diagnostic fields were reviewed to identify the number of diagnoses for each of the 40 diseases of interest, during one year. For example, if a Tennessee resident utilizes a Tennessee hospital five times for asthma in 2000 and three times for ischemic heart disease in 2000, one asthma patient and one ischemic heart disease patient will be counted for 2000 accordingly. If that same Tennessee resident utilizes a Tennessee hospital an additional four times for asthma in 2001, he or she will also be counted as an asthma patient in 2001. Groups of multiple diagnoses were not considered in this analysis. Finally, considering differences in data quality and time frames, in-patient data was analyzed independently from out-patient data. That being the case, it is possible for one individual to be both and in-patient and out-patient for the same conditions in any given year.

After determining the number of patients seen at least once for each of the 40 diseases evaluated, crude and mean disease rates for Loudon County, Franklin County, and the state of Tennessee were calculated using population estimates for each year provided by the Tennessee Division of Health Statistics that are routinely used for other analyses. This readily allows comparison of results of these analyses to other reports produced the Division of Health Statistics. These same population data were also used to calculate death rates and cancer incidence rates for each year that data were available. All rate calculations and statistical tests of difference were performed using SAS. The median age and age range for each of the diseases evaluated were also calculated in SAS. Age-adjustment of rates was performed, but added no further insights into the health picture of Loudon County.

The first goal of the detailed data analysis was to address the question: Do the disease rates for Loudon County differ significantly over time when compared to Franklin County and the state of Tennessee? Given the data limitations, the statistical method that most appropriately targets this question is the student t-test where variance among annual rates is taken into account. This method calculates a mean rate from annual disease rates and compares how annual disease rates differ from the mean. It also calculates a p-value to indicate how significant differences from the mean are.

An additional goal of the detailed data analysis was to address the question: relatively speaking, how does the health experience differ between Loudon County, Franklin County and the state of Tennessee? While this seems similar to the question about differences over time, this second question is less concerned with change over time and more interested in broader, big picture, differences. Crude rates can sometimes be more sensitive to changes in population structure than mean rates so both rates were used in this public health assessment. Rate ratios were also calculated, comparing the crude rates in Loudon County to the crude rates in Franklin County and Tennessee.

Mortality records for the years 1990 through 2003 are complete and reliable. As mentioned above, out-patient hospital data may miss some cases of disease if the person saw a private physician at his office not associated with a hospital or if the hospital clinic chooses not to report. This data is, therefore, not as reliable as other data. In-patient hospital data is much more reliable and complete than out-patient data for the years 1997 through 2003; reporting from area hospitals is required by law and is generally good. Both in-patient and out-patient hospital data exclude visits to hospitals outside of Tennessee. TCR incidence data is about 80% complete. Since the reporting of cancer incidence is voluntary, some types of cancer may be reported more thoroughly than others. For example, more aggressive cancers with shorter survival likelihoods may be missed as incidence cases and only captured as mortality events. None of the four data sources is perfect; each has its strengths and weaknesses. Furthermore, lifestyle and occupational history information does not accompany any of the health data reviewed. For these reasons, analysis of the data can be used as indicators of statistically significant rate differences, but not as definitive conclusions about the health status of a county or community. A summary of data limitations follows.

Death Data Limitations: These are the most accurate of the data sources considered. It is possible that some non-military-related deaths of Tennessee residents occurring abroad are not captured. Additional efforts were not made to verify diagnoses.

TCR Incidence Limitations: TCR reports these data to be approximately 80% complete. No attempts were made to distinguish diagnoses originating in Tennessee from those originating elsewhere. No attempts were made to distinguish current conditions from resolved conditions.

Hospital Data Limitations: These data exclude all health care encounters at private clinics and other non-hospital facilities as well as self-treatment. Said another way, these data reflect illnesses severe enough to require some form of hospitalization. They are not likely to reflect early detection of disease or the entire disease experience of any one county or Tennessee. In spite of the efforts taken to identify unique patients, missing or incorrect information for some records may have prevented the complete detection of duplicate patients. Likewise, such errors make it possible for a person to be counted as a resident of more than one county in any given year. No attempts were made to verify diagnoses reported in the hospital records with laboratory results or other information. No attempts were made to distinguish diagnoses originating in Tennessee from those originating elsewhere. No attempts were made to distinguish current conditions from resolved conditions. In-patient and out-patient hospital data is only from Tennessee hospitals, not from any other states.

Interpretations of Rates, p-values, and Rate Ratios

Interpretations of differences in health experiences among Loudon County, Franklin County and Tennessee residents is no easy task in this health assessment for a number of reasons. As already discussed, due to data set limitations, we reviewed out-patient hospitalization, in-patient hospitalization, cancer incidence, and death experiences in order to best ascertain the disease experience of the populations under comparison. Each of these data sets represents a different health snap shot. Although only 80% complete, cancer incidence data provides a verified picture of the cancer experience. While diagnoses of hospitalization are not verified, such data helps extend the cancer experience picture to some degree, provides some indication of severity (out-patients tending to be less severe cases than in-patients), and provides insight about non-cancer health experiences such as respiratory and heart diseases that community members wanted to know more about. Death data, the most accurate of the data sets, identifies the final and most severe cancer and non-cancer disease experiences. When we observed consistent trends across all four of the data sets, we can be most confident in our interpretations. Such consistencies, however, do not always present themselves and the inconsistencies that take their place may raise more questions than they answer.

In our efforts to develop the most sound interpretations possible, we considered: 1) data set limitations; 2) problems that result when rates are based on frequencies less than 20, especially when based on multiple years of data (e.g., a minimum of six years for hospital out-patients and a maximum of 14 years for death data) where an increase or decrease in a single case can markedly change the degree of statistical significance; 3) rate variation and stability over time; 4) confidence interval ranges with less confidence in larger ranges; and 5) strength of p-values, especially under conditions with large variation. Each data set represents a slightly different health perspective; therefore, we evaluated the data sets independently for each of the 41 diseases of interest. In each instance, we asked the following questions:

1) Is the median age and age range of cases for a particular disease markedly different between comparison populations? Describe this in the discussion.
2) Does the p-value corresponding to the student t-test that compared differences in mean rates suggest a statistically significant difference in the comparison populations (i.e., 0.05 or lower)? If so, indicate that.
3) Does the crude rate ratio suggest a statistically significant difference in the comparison populations (i.e., one is not included in the 95% confidence interval)? If so, do the confidence intervals for the rates of the comparison populations not overlap? When both of these conditions are met, we can be more confident in observed differences and indicate that. Also consider how wide the confidence interval is, as we have less confidence in wider ranges. Also consider if these conditions are met for age-adjusted rates and age-adjusted rate ratios.
4) From a statistical standpoint, are both the p-values and rate ratios significantly different? When such consistency is observed, we can be more confident in a difference existing. Indicate such occurrences.
5) Are statistically significant differences observed across data sets? When such consistency is observed, we can be more confident in a difference existing. Indicate such occurrences.
6) Is it possible that statistically significant differences are an artifact of problems that arise when disease frequencies are less than 20? If so, indicate this.
7) Is it biologically plausible that statistically significant differences may be associated with the contaminants of interest? If so, indicate this but acknowledge that we do not have information available about additional risk factors such as tobacco use and other lifestyle/behavioral risk factors that also contribute to disease occurrence.
8) All things considered, make the most informative statement possible about observed differences.

After answering these questions for each of the 41 diseases under study, we also considered trends across diseases affecting common organs (e.g., chronic respiratory diseases, diseases of the heart). The findings are summarized in the results section below.

Results

Results of the initial analyses using data from the HIT site are that the number one cause of death for both counties and the state every year was diseases of the heart. The number two cause of death for both counties and the state every year was malignant neoplasms. The third through tenth causes of death varied somewhat among the two counties and the state each year. For nine of the thirteen years of data examined, the third leading cause of death for both counties and the state was cerebrovascular disease. For the fourth, fifth, sixth and seventh causes of death, mostly the same causes appear each year, but the rankings change. For the eighth, ninth, and tenth causes of death, the numbers of deaths each year in Loudon and Franklin Counties are too small for meaningful analysis. The leading causes of death that remained among the top seven include:

- Diseases of the heart
- All malignant neoplasms
- Cerebrovascular diseases
- Accidents
- Chronic lower respiratory diseases
- Influenza and pneumonia
- Diabetes mellitus.

Using Tennessee Cancer Registry data and mean rates, Loudon's rank in Tennessee is number 1 for both sexes combined, 3 for females, and 2 for males (Table 17). Loudon County does not rank as high for deaths from cancer or for in-patient and out-patient hospital data. The reasons for the discrepancies are unknown. The frequency of all cancers combined is large, making rates very stable. The rankings using different databases vary considerably. This is expected. The most reliable data sets, TCR and death data, indicate that Loudon County has a high incidence rate for all cancers combined, but has much lower rankings for cancer deaths. For death data, males in Loudon and Franklin Counties have almost identical rankings, while females in Loudon County have a higher ranking for cancer deaths than females in Franklin County.

Table 17. Comparisons of total cancer rankings, Loudon County and Franklin County, Tennessee. 1991 – 2000.

	Loudon County			Franklin County		
Ranking based on mean rates						
Data Source	**Female**	**Male**	**Total**	**Female**	**Male**	**Total**
TCR	3	2	1	68	55	65
Death	14	33	24	56	34	43
In-Patient	10	10	9	50	22	29
Out-Patient	15	22	15	53	26	34
Ranking based on crude rates						
TCR	3	2	2	68	51	65
Death	14	34	24	57	35	43
In-Patient	9	10	9	30	22	30
Out-Patient	18	22	18	46	25	34

Tables 18, 19, 20, and 22 detail the top 5 cancers for each dataset for Loudon County. The top 5 types of cancers in Loudon County are the same as in the rest of the U.S.A.

Table 18. Percentage of top 5 cancers based on number of cases for females, males, and total for combined sexes. Loudon County, Tennessee. 1991-2000.

Sex	Rank				
	1	2	3	4	5
Female	Breast (31%)	Bronchus/Lung (14%)	Colon (9%)	Uterine (6%)	Ovary (4%)
Male	Prostate (25%)	Bronchus/Lung (23%)	Colon (8%)	Bladder (6%)	Kidney (4%)
Total	Bronchus/Lung (18%)	Breast (15%)	Prostate (13%)	Colon (9%)	Bladder (5%)

Table 19. Percentage of top 5 cancers based on deaths for females, males, and total for combined sexes. Loudon County, Tennessee. 1990-2003.

Sex	Rank				
	1	2	3	4	5
Female	Bronchus/Lung (25%)	Breast (14%)	Colon (8%)	Ovary (6%)	Non-Hodgkin's Lymphoma (5%)
Male	Bronchus/Lung (41%)	Prostate (11%)	Colon (7%)	Non-Hodgkin's Lymphoma (4%)	Brain (4%)
Total	Bronchus/Lung (33%)	Colon (8%)	Breast (6%)	Prostate (6%)	Non-Hodgkin's Lymphoma (4%)

Table 20. Percentage of top 5 cancers based in-patient hospitalizations for females, males, and total for combined sexes. Loudon County, Tennessee. 1997-2003.

Sex	Rank				
	1	2	3	4	5
Female	Breast (14%)	Bronchus/Lung (12%)	Colon (8%)	Ovary (5%)	Uterine (5%)
Male	Prostate (21%)	Bronchus/Lung (18%)	Colon (7%)	Kidney (4%)	Bladder (4%)
Total	Bronchus/Lung (15%)	Prostate (11%)	Colon (7%)	Breast (7%)	Rectum (3%)

Table 21. Percentage of top 5 cancers based on out-patient hospitalizations for females, males, and total for combined sexes. Loudon County, Tennessee. 1998-2001.

Sex	Rank				
	1	2	3	4	5
Female	Breast (26%)	Bronchus/Lung (10%)	Bladder (4%)	Ovary (3%)	Colon (3%)
Male	Bronchus/Lung (15%)	Prostate (11%)	Bladder (10%)	Kidney (3%)	Colon (2%)
Total	Breast (13%)	Bronchus/Lung (13%)	Bladder (7%)	Prostate (6%)	Colon (3%)

Disease frequencies, crude rates and ratios with 95% confidence limits, mean rates, median age, age range, p-values resulting from t-test analyses are provided in Appendix E. Age-adjustment added no new information nor clarified any conclusions, therefore age-adjusted rates are not included in the tables. A more detailed discussion of individual cancers and other diseases is included in Appendices F. Appendix G contains tables of rankings of disease for the different data sets. Appendix H details the methods used for analyses as well as how decisions were made about the significance and relevance of the results.

All applicable databases (TCR incidence data is not applicable for non-cancers) showed a significantly higher mean rate for both sexes combined, females, and males for ischemic heart diseases for Loudon County compared to Tennessee. The mean rates for both sexes combined and females were not different for Loudon County compared to Franklin County. Loudon County males had a slightly significantly higher mean death rate than Franklin County males, but did not differ with respect to in-patient or out-patient visits.

For ischemic heart disease, Loudon County ranked number 38th in the state for females, 28th for males, and 33rd for both sexes combined using data from mortality records. Using out-patient data, females in Loudon County ranked 10th, males ranked 12th, and both sexes combined ranked 11th. Using in-patient data, females in Loudon County ranked 26th, males ranked 18th, and both sexes combined ranked 24th.

Formaldehyde acts on the nose and pharynx rather than at more distant sites, both for cancer and non-cancer effects. For these reasons EEP looked at rates for chronic rhinitis and sinusitis. In-patient and out-patient hospitalization rates for chronic rhinitis and sinusitis are elevated compared to Tennessee and Franklin County for females, males, and both sexes combined. This is the only disease for which this is the case. There were too few deaths in Loudon and Franklin Counties for statistical analysis.

Chronic rhinitis and sinusitis can be caused by factors other than chemical air pollutants. Allergens found in many plants in the Great Smoky Mountains and nearby environs may contribute to the problem. In addition, sinusitis can be caused by viral and bacterial infections, although health outcome data gave no definitive answers about the rates of upper respiratory infections.

Using out-patient data, Loudon county females ranked 16th, males ranked 10th, and both sexes combined ranked 14th. Using in-patient data, Loudon County females ranked 18th, males ranked 25th, and both sexes combined ranked 14th.

Public Health Implications

Health Outcome Data and HAPs

It is important to note that none of the health outcome databases is perfect. Data from death certificates is the most complete and reliable; data comparisons using the mortality data yields the most reliable statistics. Even this data does not yield meaningful statistics if the numbers of deaths from a particular cause are very small. The hospital in-patient data is generally reliable, but not perfect. The hospital out-patient data is the most unreliable because reporting is voluntary. The TCR data is 80% complete as a whole, with some causes of cancer possibly under-reported while other causes of cancer may have very good reporting. Reporting reliability may vary from one region to another. Because none of the datasets is perfect, EEP used all four for comparisons.

Interpretation of the data from four datasets is complex in the absence of clear patterns. In general, the data is showing that, for most diseases, the rates in Loudon County are similar to the rates in the comparison county, Franklin, and in Tennessee. It is impossible to know if occasional higher or lower rates are meaningful. For many of the diseases for which Loudon County had higher rates of disease incidence or prevalence, the death rates were not significantly different from the rates of Franklin County or Tennessee, and in some cases they were significantly lower.

Although the incidence rate for bronchus and lung cancer was higher for Loudon County compared to Tennessee when data for both sexes was combined, it is unclear what this means because rates for females and males were not consistently higher. Analysis of mortality data did not reveal any significant differences when males and females were compared to Tennessee rates or for any mortality comparisons with Franklin County.

Since smoking history is associated with bronchus and lung cancer, knowing the rate of smoking in Loudon and Franklin Counties would be very helpful. This data comes from the Behavioral Risk Factor Surveillance System (BRFSS) which has reliable data for the state as a whole, but not for individual counties. In Loudon County, BRFSS data for 2003 indicate that 27.3% of people smoked tobacco, compared to Franklin County where 28.6% of people smoked. These percentages were calculated from 21 interviews in Franklin County and 22 interviews in Loudon County. BRFSS has smoking data each year from 1990 through 2004, with the number of interviews ranging from 8 to 28, and a range of percentage of smokers from 7.7% to 66.7% (average 25.2%). The smoking rate for the Knoxville Standard Metropolitan Statistical Area (SMSA) using BRFSS data for the year 2000 indicates that the cigarette smoking rate for the SMSA is 30.5%, compared to 25.7% for the state (MMWR 2001). The Knoxville SMSA for this report includes Knox, Blount, and Union Counties, but does not include Loudon County (David Riding, BRFS, personal communication).

There were too few (extremely small numbers) nasopharyngeal cancers for any meaningful analysis. Because the levels of acetaldehyde and formaldehyde at the HAPs monitor are similar to other areas in the U.S.A., an increased rate of nasopharyngeal cancers from exposures would not be expected. In addition, the WHO has set its guideline for formaldehyde in ambient air at

0.1 mg/m^3 (81 ppb), a value representing an exposure level at which there is a negligible risk of upper respiratory tract cancer in humans (WHO 2000). This is above the concentrations found in Loudon County.

The rate of acute myeloid leukemia (associated with benzene exposure) is not elevated in Loudon County. This is in concordance with the concentrations of benzene found in Loudon County which are similar to other areas in the U.S. and with results of occupational epidemiologic studies that found that exposures to less than 1,000 ppb benzene are not associated with any significant changes in blood indices.

The rate of liver cancer in Loudon County was essentially the same as in Franklin County and Tennessee. This again is in concordance with what is known about the toxicology of carbon tetrachloride.

The ranking of Loudon County's cancer rate is number 3 for females, 2 for males, and number 1 for both sexes combined. The most reliable datasets for ranking are the mortality records and the TCR data. Using data from these sources, the leading causes of cancer in Loudon County are bronchus/lung, colon, breast, prostate, non-Hodgkin's lymphoma, brain (for males), and ovary (for females). Although the causes of cancer are complex and unknown, most research does not indicate a chemical pollution link between colon, breast, uterine, ovarian, and prostate cancers. Bronchus/lung cancer is often associated with smoking, but exposure to chemicals from other sources, such as occupational exposures, cannot be ruled out.

The concentrations of HAPs found in Loudon County that are known or probable human carcinogens are similar to concentrations found elsewhere in the U.S. Therefore, these chemicals in ambient air are unlikely to be the cause of the increased cancer rates in Loudon County. The health data available for analysis covered the years 1990 through 2003 for mortality, 1997 through 2003 for inpatients, 1998 through 2003 for outpatients, and 1991 through 2000 for cancers. All the health data precedes the dates of air sampling, from November 2004 through December 31, 2005. Therefore no conclusions about HAPs causing any increases in rates can be drawn.

Cancer is not one disease; each type of cancer has it own risk factors and causes. Cancer is caused by a combination of internal factors, such as inherited mutations, hormones, immune conditions, and mutations that may occur from metabolism), and external factors, such exposure to tobacco, chemicals, radiation, and infectious organisms. These internal and external factors work together or in sequence to initiate or promote the growth of cancerous cells. Many years often pass between exposure to external factors and the appearance of cancer. The leading causes of cancer deaths in the U.S. are bronchus/lung, prostate, and colon and rectal cancers (ACS 2005).

The rate for ischemic heart disease is consistently elevated when compared to Tennessee for females, males, and both sexes combined. However, no rates were elevated when compared with Franklin County. The interpretation of this is unclear; however, heart disease is the leading cause of death in Tennessee. There is evidence of increased risk of or complications of respiratory and cardiovascular diseases from exposure to particulate matter (EPA 2004c, Park

2005, Brook 2004). Making inferences about the association between concentrations of pollutants and health outcomes is not the purpose of a public health assessment. In addition, because the health outcome data precedes the HAPs monitoring in time, it is impossible to draw conclusions about causality in this public health assessment.

One possibility for the higher rates of in-patient and out-patient diseases in Loudon County could be good insurance coverage and access to medical care that does not exist in some parts of Tennessee. If this were the case, it could explain higher rates of diagnoses, coupled with lower death rates. Another possibility is that in the last ten years, 3,000 to 4,000 retirees have moved into Loudon County. Heart disease and cancer are more prevalent in older populations. As the older population increases, rates for these diseases may also increase. The increased cancer rate could be an artifact of reporting biases between different regions of Tennessee.

Odors

The lowest reported odor threshold for acetaldehyde, formaldehyde, and carbon disulfide are 2.8 ppb, 20 ppb, and 10 ppb respectively (HazMap], although a range exists for odor thresholds. The odor threshold for acetaldehyde ranges from 2.8 to 1,000,000 ppb, with a mean value of 67 ppb. Formaldehyde has an even larger range of thresholds: 27 to 9,800,000 ppb. Carbon disulfide has a much narrower range for odor threshold: 16 to 420 ppb (TRC 1988). It is likely that odors would be detected near the HAPs monitor. Occasionally, winds out of the northwest or northeast could transport emissions from Blair Bend Industrial Park to the Tellico Village area and other areas of Loudon. Odors, whether from industry or a mixture of sources, are most likely to come from a mixture of chemicals, rather than just these three.

Whether or not detected odors are offensive is subjective, depending upon many factors. Many people in Loudon County have reported smelling offensive odors. Quality of life issues associated with offensive odors are important for all citizens of Loudon County. Offensive odors can keep people from exercising, gardening, and, in general, from being out of doors.

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Community Concerns

EEP held an open house in Loudon on July 14 and 15, 2004, for the purpose of identifying concerns of people living there. EEP staff talked with people individually so that we could understand their health concerns, potential sources of pollution, and the best way to communicate our findings to the community.

A fact sheet describing the Public Health Assessment process as well as a brochure about EEP was available for everyone who attended. The Clean Air Friends-Clean Air Kids agreed to share our information with people who were unable to attend. Several people called us with their concerns. In total, EEP talked with about 40 people. In general, the community is concerned about their health, the health of their children and grandchildren, and the environmental health of Loudon County.

Most people want to receive information about environmental issues by mail, articles in local newspapers, formal presentations by experts, and community open houses. In addition, most people do not believe that local and state governments have made appropriate responses to community concerns about air pollution and health.

Questions and comments from the community gathered at the open house, along with responses from EEP, are detailed in Appendix I.

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Conclusions

EEP evaluated available environmental data and health outcome data to assess the public health hazard from hazardous air pollutants. Conclusions are detailed below.

Specific conclusions for chemicals:

- **Indeterminate public health hazard from past exposures to HAPs.**

No data exists for concentrations of hazardous air pollutants in Loudon County prior to November 15, 2003. Therefore, the public health hazard from past exposures cannot be determined.

- **No apparent public health hazard from benzene in air as measured at the HAPs monitor.**

Although benzene measured at the HAPs monitor (mean = 0.38 ppb) was above EPA's risk range for one excess cancer per million people, the concentrations are below the normal background concentrations found across the U.S. (2.8 to 20 ppb). In addition, epidemiologic studies of people occupationally exposed to benzene have found no excess cancer deaths from exposures to benzene in concentrations less than 1,000 ppb. The Loudon County rates of acute myeloid leukemia (associated with higher occupational benzene exposures) are no different from the rates for Franklin County or Tennessee.

- **No apparent public health hazard from carbon tetrachloride in air as measured at the HAPs monitor.**

Although carbon tetrachloride measured at the HAPs monitor (mean = 0.09 ppb) was above EPA's risk number for one excess cancer per million people, it is below ATSDR's guidance for chronic exposures for non-cancer effects (30 ppb). Concentrations of 0.1 ppb of carbon tetrachloride are common around the world, so the concentrations in Loudon County at the point measured are not different from concentrations found elsewhere.

In general, the rates of liver cancer (possible association with carbon tetrachloride exposure) in Loudon County are not statistically significantly different from the rates in Franklin County or Tennessee.

- **No apparent public health hazard from acetaldehyde in air as measured at the HAPs monitor.**

Although acetaldehyde measured at the HAPs monitor (mean = 1.97 ppb) was above ATSDR's and EPA's risk number for one excess cancer per million people, it is below the EPA guidance for chronic exposures, a reference concentration of 5 ppb for non-carcinogenic effects. The concentrations are below the normal background concentrations found across the U.S.

The Science Advisory Board at EPA began a review of the acetaldehyde risk assessment in 2003; this review is not complete at this time. It is unknown how the results of the review will change the unit risk values used to predict excess cancer risk. In some animal testing, acetaldehyde was associated with carcinomas in the nasal mucosa and larynx.

In general, rates of nasopharygeal cancer in Loudon County are no different from the rates in Franklin County and Tennessee, although the frequencies are extremely low.

- **Indeterminate health hazard from exposure to formaldehyde in air as measured at the HAPs monitor from November 15, 2003, through April 9, 2004.**

- **No apparent health hazard from exposure to formaldehyde in air as measured at the HAPs monitor from April 21, 2004 through December 24, 2005.**

The mean and median concentrations of formaldehyde measured at the HAPs monitor are somewhat confusing. The mean concentration measured between November 15, 2003, and April 9, 2004, was 19.8 ppb, while the mean measured after April 9, 2004, through December 24 2005, was 1.62 ppb. These concentrations are above the current EPA ambient air level guidance of 0.06 ppb for carcinogenic effects. The concentrations measured from November 2003 to April 9, 2004, are above the ATSDR guidance for chronic exposures of 8 ppb for non-carcinogenic effects while the concentrations measured after April 9, 2004, are below the ATSDR guidance.

The validity of the data for formaldehyde measured between November 15, 2003, and April 9, 2004, is in doubt. When compared to data from 39 other sites in the U.S., the Loudon data for 2003 represents an extreme outlier, with the 2003 mean and standard deviation of individual data points approximately 3 times the next highest mean and standard deviation. The Division of Air Pollution Control can find no source that emits enough formaldehyde to account for these levels. For these reasons, the Division of Air Pollution Control has serious doubts about the earlier data.

EPA is re-assessing its risk assessment for formaldehyde, but is awaiting conclusions from an occupational epidemiologic study that the National Cancer Institute (NCI) is conducting. It is unknown how the results of the re-assessment will change the unit risk values used to predict excess cancer risk. Occupational exposures to formaldehyde have been associated with cancer of the nose and pharynx.

In general, rates of nasopharygeal cancer in Loudon County are no different from the rates in Franklin County and Tennessee, although the frequencies are extremely low.
If only the latter data is considered (April 21 through December 23, 2004), no apparent public health hazard exists from exposure to formaldehyde.

- **No apparent health hazard from exposure to carbon disulfide in air as measured at the HAPs monitor.**

Although concentrations of carbon disulfide measured at the HAPs monitor are higher than concentrations found in many areas of the U.S., the concentrations are well below levels that could cause adverse health effects.

- **Indeterminate health hazard from exposure to $PM_{2.5}$ in air as measured at the particulate monitor and from ozone measured at the ozone monitor.**

The ambient air standard for $PM_{2.5}$ is the 3-year average of the weighted annual mean. This 3-year average is not to exceed 15.0 $\mu g/m^3$. The ozone standard 80 ppb, measured as the average of the fourth highest ozone level measured in each of three years. Loudon County does not have 3 years of particulate or ozone data, so it is impossible to know if Loudon County is in compliance.

- **Indeterminate health hazard from exposure to mixtures of air pollutants.**

Because the in-patient and out-patient hospitalization rates of chronic rhinitis and sinusitis in Loudon County compared to Franklin County and Tennessee are statistically significantly higher for females, males, and both sexes combined and the site of adverse health effects from acetaldehyde and formaldehyde are at the portal of entry (the nose), it is possible that acetaldehyde and formaldehyde, along with other aldehydes, other chemicals, natural products, and ozone and particulate matter are contributing to upper respiratory irritation in people in Loudon County, either directly or through their contribution to ozone levels.

- **Offensive odors can negatively affect quality of life.**

Every reasonable alternative should be considered for lowering emissions from industrial processes with strong odors.

Specific conclusions about health outcome data:

Although specific conclusions from different databases can be drawn, there is a general lack of convergence of the analyses toward the same general health picture. Therefore, the confidence in the specific conclusions is good, while the confidence in the overall health status of Loudon County is less certain.

- **Loudon County has statistically significant increased in-patient and out-patient hospitalization rates for chronic rhinitis and sinusitis compared to Franklin County and Tennessee for females, males, and both sexes combined.**

The death rate from chronic rhinitis and sinusitis is not elevated. Causation cannot be established in this public health assessment. It is likely that many factors are working together to cause this effect; ozone, also, contributes to irritation of the nasal passages. Other factors include exposure to industrial emissions, vehicular exhaust, local allergens, and other undetermined sources of upper respiratory irritation.

- **Loudon County is ranked 1st in overall cancer rate in Tennessee for both sexes combined, is ranked 2nd in overall cancer rate for males, and is ranked 3rd in overall cancer rates for females.**

Bronchus and lung cancer, colon cancer, breast cancer, and prostate cancer are the top 4 types of cancer in the U.S. and in Loudon County. The median ages and age ranges found in Loudon County were not different from the age medians and ranges in Franklin County or Tennessee, nor did age-adjustment of rates provide any addition information. Smoking is the main cause of bronchus and lung cancer and bladder cancer. These cancers are not known to be associated with the individual HAPs measured in Loudon County. In addition, nothing is known about the length of residence in Loudon County for cancer cases. This public health assessment cannot assign causation for the increased rate of cancer.

- **Loudon County has a statistically significant higher rate of bronchus and lung cancer compared to Tennessee for both sexes combined using in-patient hospitalization, Tennessee Cancer Registry, and mortality data.**

It is interesting to note that rates for females are not elevated across all datasets. The rate for males is elevated across all datasets when compared to Tennessee, which leads to more confidence in the conclusion of higher bronchus and lung cancer rates in Loudon County males. The percentage of people who smoke tobacco in Loudon and Franklin Counties is very similar, although the data are not robust (22 respondents in Loudon County and 21 respondents in Franklin County for the BRFFS interviews). Even though there is good confidence in the higher rate of bronchus and lung cancer in Loudon County males, causation cannot be established in this public health assessment.

- **Loudon County has a statistically significant increased rate of ischemic heart disease compared to Tennessee using in-patient and out-patient hospitalization and mortality data.**

Although causation cannot be established in this public health assessment, an association between $PM_{2.5}$ and coronary artery diseases (within the International Code of Diseases, 10th Revision (ICD-10), for ischemic heart disease) cannot be ruled out within Loudon County. The ICD-10 code used for analyzing data in this document (I20-I25) includes other specific diseases, in addition to coronary artery disease.

- **Loudon County has a statistically significant increased rate of chronic bronchitis for some comparisons, but not all.**

Loudon County has elevated rates for females, males, and both sexes combined when compared to Tennessee using in-patient and out-patient data. Using this same data, Loudon County males have a higher rate than Franklin County males. Death rates are elevated for Loudon County females compared to Franklin County, but not with other comparisons. It is possible that an association between chronic bronchitis and ozone levels exists in Loudon County, although asthma rates and other lower respiratory diseases do not show clear trends supporting this hypothesis.

- **Causes of any increased rates cannot be determined at this time.**

The purpose of this public health assessment was to look at existing environmental and health data to evaluate the public health implications of environmental pollution. This process is not a health study or an analytical epidemiologic study that is designed to test hypotheses of causation. Cancers which are associated with exposures to chemicals have a long lag time before development. The lag time varies from 10 to 40 years after exposure to the development of cancer. EEP looked at current air data and cancer data from 1991 to 2000. Timing of available data is one factor that makes establishment of causation impossible.

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Recommendations

Based on the assessment of environmental data and health outcome data, Environmental Epidemiology (EEP) makes the following recommendations:

- TDEC should continue to ensure that Loudon County industries meet applicable regulatory air standards.

- TDEC should quantitatively determine the contributions of acetaldehyde and formaldehyde from industrial, vehicular, and other sources to the ambient air in Loudon County. These chemicals may cause nasal irritation themselves, and they may contribute to ozone levels in Loudon County. TDEC has compiled some data to meet this recommendation under the title of: *Loudon, Tennessee NEI Emissions Data, Evaluation of 1999 data with Comparisons to State and Loudon County Data. Sampling and analysis at other locations would be helpful.*

- TDEC should try to determine why there is discrepancy between the concentrations of formaldehyde measured between November 15, 2003, to April 9, 2004, and April 21, 2004, to December 24, 2005.

  TDEC has been working on this issue since April 2004. The levels have remained lower, giving rise to doubt that the earlier data are valid.

- Area industries should make all reasonable efforts to lessen offensive odors. Quality of life issues associated with offensive odors are important for all citizens of Loudon County, employers and employees, school children, the elderly – everyone who lives and works in Loudon County.

- Local citizens should avoid strenuous outdoor activity when air alerts are posted for elevated allergen levels, ozone, or particulate matter.

- TDEC and the TWRA should continue to publicize fish advisories along area water ways.

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Public Health Action Plan

The Public Health Action Plan for Loudon County Hazardous Air Pollutants contains a description of action to be taken by TDEC, TDH, EEP, and others subsequent to the completion of this PHA. The purpose of the Public Health Action Plan is to ensure that the PHA not only identifies potential and ongoing public health hazards, but also provides a plan of action designed to mitigate and prevent adverse human health effects resulting from exposure to hazardous substances in the environment. The public health actions that are planned are listed below.

1. EEP will continue to work with the Tennessee Department of Environment and Conservation, Division of Air Pollution Control, on potential health issues related to hazardous air pollutants (HAPs).

2. EEP will provide a copy of this Public Health Assessment to TDEC, the Knoxville Regional Early Action Compact committee, the Loudon County Air Quality Task Force, the Loudon County Health Council, other communities groups in Loudon County, and to anyone interested in the report.

3. EEP will more closely evaluate those health outcome data that are elevated.

4. The Tennessee Department of Health will discourage the use of in-home electronic devices that may increase the indoor air concentrations of ozone.

5. The Tennessee Department of Health will provide education about sources of indoor air pollution, especially from aldehydes, and ways to minimize indoor exposures.

6. The Tennessee Department of Health will encourage citizens in Loudon County to use simple measures that will lessen exposure to local allergens, such as the use of heating, ventilation, and air conditioning intake filters that capture allergens.

7. The Public Health Assessment will be available for viewing or download from the State of Tennessee Department of Health website, www.tennessee.gov/health.

8. EEP will provide assistance in educating people about air alerts and allergen avoidance.

9. EEP will encourage TDEC and TWRA to continue to publicize fish advisories.

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Figure 1: Map of Loudon County with major interstates, air permitted industries, residential areas, water bodies, and schools noted.

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Appendix A
Concentrations of Hazardous Air Pollutants
Loudon, Loudon County, Tennessee
November 15, 2003 –December 24, 2005

The table is continued for 10 pages, with 2 pages for each time period.

Hazardous Air Pollutants, Loudon County, Tennessee, November 15, 2003 – April 9, 2004

Compound (ppbv)	11/5/2003	11/17/2003	11/29/2003	12/11/2003	12/23/2003	1/4/2004	1/16/2004	1/28/2004	2/9/2004	2/21/2004	3/4/2004	3/22/2004	3/28/2004	4/9/2004
Canister Results														
1,1,1-Trichloroethane	0.03													
1,1,2,2-Tetrachloroethane														
1,1,2-Trichloroethane														
1,1-Dichloroethane														
1,1-Dichloroethene														
1,2,4-Trichlorobenzene														
1,2,4-Trimethylbenzene	2.26	0.17							0.08	0.08	0.14	0.06	0.12	
1,2-Dibromoethane														
1,2-Dichloroethane														
1,2-Dichloropropane														
1,3,5-Trimethylbenzene	0.81									0.04	0.05		0.04	
1,3-Butadiene	0.05													
Acetonitrile	116.85	294.00	192.81	67.79	237.35	*Note		*Note	*Note	*Note	*Note	*Note	*Note	*Note
Acetylene	0.56	2.63	0.69	0.87	1.12	0.36		0.6	0.96	0.77	1.11	0.74	0.69	0.52
Acrolein (Added New July 2005)														
Acrylonitrile														
Benzene	0.49	0.68	0.19	0.24	0.27	0.19		0.22	0.27	0.24	0.34	0.19	0.27	0.2
Bromochloromethane														
Bromodichloromethane														
Bromoform														
Bromomethane	0.02													
Carbon Tetrachloride	0.08				0.07			0.09	0.06	0.07	0.09		0.08	0.08
Chlorobenzene														
Chloroethane	0.30													
Chloroform	0.18									0.04				0.11
Chloromethane	0.65	0.53	0.48	0.49	0.52	0.57		0.51		0.67	0.51	0.56	0.51	0.5
Chloromethylbenzene														
Chloroprene														
cis-1,2-Dichloroethylene														
cis-1,3-Dichloropropene														
Dibromochloromethane														
Dichlorodifluoromethane	0.47	0.56	0.61	0.55	0.57	0.57		0.49	0.5	0.59	0.48	0.55	0.49	0.47
Dichloromethane	0.12													
Dichlorotetrafluoroethane														
Ethyl Acrylate														

Hazardous Air Pollutants, Loudon County, Tennessee, November 15, 2003 – April 9, 2004, continued

Compound (ppbv)	11/5/2003	11/17/2003	11/29/2003	12/11/2003	12/23/2003	1/4/2004	1/16/2004	1/28/2004	2/9/2004	2/21/2004	3/4/2004	3/22/2004	3/28/2004	4/9/2004
Ethyl tert-Butyl Ether														
Ethylbenzene	0.47	0.15						0.04	0.06	0.06	0.13	0.04	0.09	
Hexachloro-1,3-Butadiene														
m,p-Xylene	2.27	0.46		0.15	0.12			0.1	0.16	0.14	0.34	0.12	0.24	0.12
m-Dichlorobenzene														
Methyl Ethyl Ketone		1.37	0.87	0.90	0.71	1.21			4.7	1.07	10.8	0.85	1.3	1.1
Methyl Isobutyl Ketone	15.06										0.3		0.11	
Methyl Methacrylate														
Methyl tert-Butyl Ether														
n-Octane	1.67										0.09			
o-Dichlorobenzene														
o-Xylene	1.03	0.22						0.05	0.07	0.07	0.14	0.06	0.11	0.05
p-Dichlorobenzene	0.04													
Propylene	0.59	0.98	0.13	0.25	0.25	0.11		0.21	0.3	0.21	0.39	0.21	0.31	0.19
Styrene	0.46	0.48						0.1		0.05	0.48	0.12	0.08	
tert-Amyl Methyl Ether														
Tetrachloroethylene	0.03													
Toluene	6.00	1.31	0.30	0.50	0.48	0.46		0.31	0.4	0.3	0.73	0.19	0.49	0.27
trans-1,2-Dichloroethylene														
trans-1,3-Dichloropropene														
Trichloroethylene														
Trichlorofluoromethane	0.62	0.23	0.27	0.42	0.27	0.31		0.24	0.25	0.3	0.26	0.26	0.23	0.23
Trichlorotrifluoroethane	0.09	0.23	0.19	0.19	0.22					0.11	0.15	0.09		0.13
Vinyl Chloride														
Cartridge Results														
2,5-Dimethylbenzaldehyde	0.07	0.07	0.06	0.03	0.04	0.038	0.067	0.07	0.025	0.036		0.008	0.007	0.016
Acetaldehyde	3.27	4.06	2.12	1.27	3.49	4.71	2.68	1.47	2.66	2.48	3.45	1.26	4.59	2.98
Acetone	0.02	0.05	0.31	7.51	4.08	1.17	8.56	7.88	6.77	6.04	2.2	8.05	2.18	5.67
Benzaldehyde	0.49	0.47	0.13	0.10	0.19	0.317	0.193	0.103	0.185	0.236	0.457	0.122	0.346	0.222
Butyr/Isobutyraldehyde	0.79	1.76	5.06	4.46	3.27	1.34	6.09	3.46	4.94	3.87	2.59	3.33	1.72	3.57
Crotonaldehyde	0.19	0.10	0.04	0.03	0.05	0.071	0.039	0.09	0.057	0.057	0.095	0.047	0.092	0.073
Formaldehyde	33.36	40.00	13.86	11.81	17.73	30.8	12.3	6.26	14.4	18.9	27.4	10.1	23.9	16.8
Hexaldehyde	3.82	4.45	1.31	1.13	2.70	3.2	1.93	0.882	2.26	2.45	2.93	0.961	2.72	1.76
Isovaleraldehyde	0.16	0.06	0.13		0.35	0.122	0.029	0.09	0.044		0.159	0.016	0.071	
Propionaldehyde	0.02	0.02	0.005	0.07	0.22	0.302	0.282	0.121	0.216	0.211	0.254	0.141	0.443	0.268
Tolualdehydes	0.65	1.04	0.58	0.30	0.64	0.789	0.282	0.054	0.267	0.372	0.272	0.103	0.274	0.303
Valeraldehyde	1.45	1.18	0.32	0.24	0.61	0.77	0.445	0.213	0.514	0.606	0.76	0.273	0.789	0.534

Hazardous Air Pollutants, Loudon County, Tennessee, April 18 – September 12, 2004

Compound (ppbv)	4/18/2004	4/21/2004	5/3/2004	5/15/2004	5/27/2004	6/8/2004	6/19/2004	7/2/2004	7/14/2004	7/26/2004	8/7/2004	8/19/2004	8/31/2004	9/12/2004
Canister Results														
1,1,1-Trichloroethane														
1,1,2,2-Tetrachloroethane														
1,1,2-Trichloroethane														
1,1-Dichloroethane														
1,1-Dichloroethene														
1,2,4-Trichlorobenzene														
1,2,4-Trimethylbenzene														
1,2-Dibromoethane	0.08	0.09	0.09	0.09	0.09	0.09	0.22	0.21	0.14	0.13	0.14	0.2	0.14	0.16
1,2-Dichloroethane														
1,2-Dichloropropane														
1,3,5-Trimethylbenzene														
1,3-Butadiene							0.06	0.06	0.04			0.07	0.04	0.05
Acetonitrile														
Acetylene	1.17	2.43	2.65	1.05	1.89	1.28	*Note	*Note	*Note	*Note	*Note	*Note	*Note	*Note
Acrolein (Added New July 2005)	0.6	0.42	0.51	0.52	0.39	1.27	0.32		0.36	0.49	0.48	0.8	0.56	0.85
Acrylonitrile														
Benzene		0.26					0.33			0.38				
Bromochloromethane	0.42	0.39	0.31	0.27	0.28	1.11	0.4	0.46	0.29	0.27	0.17	0.45	0.45	0.36
Bromodichloromethane														
Bromoform														
Bromomethane														
Carbon Tetrachloride														
Chlorobenzene	0.1	0.07	0.09	0.07	0.09	0.09	0.1	0.08	0.07	0.11	0.09	0.11	0.1	0.11
Chloroethane														
Chloroform										0.15		0.13		
Chloromethane	0.14			0.15	0.07	0.15	0.04	0.04	0.05	0.04		0.06		0.05
Chloromethylbenzene	0.53	0.5	0.51	0.66	0.69	0.67	0.68	0.94	0.68	0.93	0.7	0.71	0.62	0.71
Chloroprene														
cis-1,2-Dichloroethylene														
cis-1,3-Dichloropropene														
Dibromochloromethane														
Dichlorodifluoromethane														
Dichloromethane	0.49	0.49	0.5	0.53	0.58	0.54	0.65	0.76	0.62	0.84	0.75	0.72	0.72	0.78
Dichlorotetrafluoroethane						0.12				0.14	0.12		0.76	
Ethyl Acrylate										0.03				

Hazardous Air Pollutants, Loudon County, Tennessee, April 18 – September 12, 2004, continued

Compound (ppbv)	4/18/2004	4/21/2004	5/3/2004	5/15/2004	5/27/2004	6/8/2004	6/19/2004	7/2/2004	7/14/2004	7/26/2004	8/7/2004	8/19/2004	8/31/2004	9/12/2004
Ethyl tert-Butyl Ether	0.06	0.09	0.08	0.06	0.08	0.1	0.16	0.15	0.1	0.09	0.08	0.15	0.12	0.12
Ethylbenzene														
Hexachloro-1,3-Butadiene	0.16	0.22	0.19	0.14	0.17	0.25	0.52	0.43	0.28	0.26	0.18	0.39	0.28	0.3
m,p-Xylene														
m-Dichlorobenzene	0.67	2.81	4.19	1.18	5.87	3.22	4.32	5.14	6.32	7.59	1.16	3.15	1.77	2.25
Methyl Ethyl Ketone		0.2	0.14		0.24	0.23	0.21	0.4	0.35	0.25		0.54	0.4	0.42
Methyl Isobutyl Ketone														
Methyl Methacrylate								0.23			0.27			
Methyl tert-Butyl Ether		0.14			0.09		0.12	0.14	0.11	0.09		0.16		0.08
n-Octane														
o-Dichlorobenzene	0.07	0.1	0.09	0.07	0.07	0.11	0.21	0.18	0.12	0.11	0.09	0.16	0.13	0.14
o-Xylene														
p-Dichlorobenzene	0.17	0.16	0.36	0.25	0.29	0.4	0.35		0.22	0.29	0.48	0.41	0.18	0.32
Propylene	0.06	0.05	0.14	0.09	0.13	0.29	0.11	0.08	0.12	0.06		0.28	0.21	0.06
Styrene														
tert-Amyl Methyl Ether														
Tetrachloroethylene	0.56	0.87	0.63	0.4	0.58	0.98	1.07	1.01	0.68	0.57	0.31	0.97	0.83	0.72
Toluene														
trans-1,2-Dichloroethylene				0.11										
trans-1,3-Dichloropropene														
Trichloroethylene	0.23	0.23	0.24	0.29	0.29	0.23	0.34	0.4	0.3	0.4	0.39	0.33	0.5	0.36
Trichlorofluoromethane	0.18	0.19	0.17		0.16	0.15		0.1	0.15	0.12	0.15	0.18	0.16	0.18
Trichlorotrifluoroethane														
Vinyl Chloride														
Cartridge Results					0.002				0.009	*				
2,5-Dimethylbenzaldehyde	2.78	2.13	0.518	1.58	1.48	1.86	0.712	1.28	1.01	*	1.07		0.709	1.32
Acetaldehyde	1.39	0.67	1	0.735	0.595	0.708	0.468	0.32	0.584	*	1.1		0.432	0.598
Acetone	0.064	0.039	0.02	0.058	0.051	0.123	0.046	0.026	0.038	*	0.021		0.04	0.014
Benzaldehyde	0.169	0.124	0.071	0.113	0.092	0.113	0.089	0.081	0.105	*	0.109		0.069	0.086
Butyr/Isobutyraldehyde	0.064	0.069	0.027	0.309	0.356	0.5	0.594	0.281	0.565	*	0.258		0.377	0.325
Crotonaldehyde	2.54	2.05	0.715	2.66	3.1	3.39	2.98	2.28	3.14	*	2.61		2.7	2.52
Formaldehyde	0.16	0.072	0.031	0.073	0.049	0.061	0.049	0.037	0.047	*	0.056		0.026	0.04
Hexaldehyde	0.123	0.075	0.006	0.053	0.026	0.049	0.021	0.032	0.023	*	0.014			0.029
Isovaleraldehyde	0.125	0.063	0.052	0.109	0.083	0.133	0.094	0.119	0.137	*	0.118		0.107	0.091
Propionaldehyde	0.033	0.017	0.021	0.043	0.043	0.02	0.048	0.024	0.026	*	0.042		0.015	0.025
Tolualdehydes	0.064	0.041	0.022	0.04	0.027	0.038	0.033	0.03	0.031	*	0.032		0.019	0.026
Valeraldehyde														

Hazardous Air Pollutants, Loudon County, Tennessee, September 24, 2004 – February 27. 2005

Compound (ppbv)	9/24/2004	10/18/2004	10/30/2004	11/5/2004	11/11/2004	11/23/2004	12/5/2004	12/17/2004	12/29/2004	1/10/2005	1/22/2005	2/3/2005	2/15/2005	2/27/2005
Canister Results														
1,1,1-Trichloroethane														
1,1,2,2-Tetrachloroethane														
1,1,2-Trichloroethane														
1,1-Dichloroethane														
1,1-Dichloroethene														
1,2,4-Trichlorobenzene														
1,2,4-Trimethylbenzene	0.14	0.09	0.1	0.21	0.09	0.11	0.08	0.09	0.14	0.11	0.08	0.11	0.09	0.16
1,2-Dibromoethane														
1,2-Dichloroethane														
1,2-Dichloropropane														
1,3,5-Trimethylbenzene	0.06			0.06		0.07	0.06		0.04	0.05	0.04		0.04	0.05
1,3-Butadiene	0.07			0.09	0.06						0.07			
Acetonitrile		*Note	*Note		*Note									
Acetylene	1.71	0.44	0.62	2.14	0.89	0.86	1.56	1.76	1.49	1.13	1.01	1.08	0.67	1.13
Acrolein (Added New July 2005)														
Acrylonitrile														
Benzene	0.57	0.2	0.34	0.55	0.28	0.28	0.6	0.59	0.69	0.53	0.44	0.48	0.41	0.93
Bromochloromethane														
Bromodichloromethane														
Bromoform														
Bromomethane														
Carbon Tetrachloride	0.1	0.12	0.07	0.09	0.06	0.07	0.12	0.07	0.08	0.09	0.09	0.08	0.09	0.12
Chlorobenzene														
Chloroethane														
Chloroform	0.17				0.15		0.06		0.1	0.08				
Chloromethane	0.62	0.74	0.75	0.73	0.48	0.47	0.55		0.49	0.5	0.5	0.51	0.59	0.69
Chloromethylbenzene														
Chloroprene														
cis-1,2-Dichloroethylene														
cis-1,3-Dichloropropene														
Dibromochloromethane														
Dichlorodifluoromethane	0.73	0.7	0.42	0.67	0.47	0.45	0.67	0.52	0.49	0.51	0.52	0.51	0.56	0.64
Dichloromethane				0.16						0.1	0.09	0.14		
Dichlorotetrafluoroethane														
Ethyl Acrylate														

Hazardous Air Pollutants, Loudon County, Tennessee, September 24, 2004 – February 27. 2005, continued

Compound (ppbv)	9/24/2004	10/18/2004	10/30/2004	11/5/2004	11/11/2004	11/23/2004	12/5/2004	12/17/2004	12/29/2004	1/10/2005	1/22/2005	2/3/2005	2/15/2005	2/27/2005
Ethyl tert-Butyl Ether														
Ethylbenzene	0.13	0.09	0.07	0.23	0.07	0.09	0.11	0.09	0.12	0.08	0.07	0.09	0.06	0.13
Hexachloro-1,3-Butadiene														
m,p-Xylene	0.35	0.16	0.15	0.46	0.17	0.24	0.22	0.19	0.25	0.17	0.12	0.17	0.12	0.26
m-Dichlorobenzene														
Methyl Ethyl Ketone	0.45	0.39	1.33		0.73	0.33	0.36	0.51	0.92	0.9	0.4	0.42	0.37	0.63
Methyl Isobutyl Ketone		1.27	0.35		0.19	0.14			0.18	0.24			0.23	
Methyl Methacrylate														
Methyl tert-Butyl Ether	0.09													
n-Octane		0.06	0.06	0.09										
o-Dichlorobenzene														
o-Xylene	0.15	0.08	0.07	0.21	0.08	0.11	0.12	0.11	0.14	0.11	0.08	0.09	0.07	0.14
p-Dichlorobenzene														
Propylene	0.55	0.32	0.24	1.1	0.41	0.39	0.59	0.53	0.68	0.41	0.35	0.33	0.24	0.6
Styrene	0.5	0.07	0.05	0.09	0.39	0.61	0.13	0.12	0.23	0.28	0.06	0.24	0.25	0.24
tert-Amyl Methyl Ether														
Tetrachloroethylene				0.06										
Toluene	0.74	0.46	0.46	2.61	0.41	0.5	0.48	0.55	0.75	0.55	0.62	0.63	0.43	0.74
trans-1,2-Dichloroethylene														
trans-1,3-Dichloropropene														
Trichloroethylene														
Trichlorofluoromethane	0.33	0.44	0.18	1.49	0.24	0.25	0.34	0.23	0.24	0.24	0.26	0.32	0.23	0.27
Trichlorotrifluoroethane	0.14	0.09	0.1	0.09	0.11	0.09	0.1		0.1	0.13	0.1	0.12	0.11	0.11
Vinyl Chloride														
Cartridge Results														
2,5-Dimethylbenzaldehyde											**			
Acetaldehyde	1.53	1.34	1.87	1.43	0.943	0.367	1.21	2.14	1.21	0.818	**	0.374	0.661	1.49
Acetone	0.768	0.479	0.358	1.28	0.548	0.701	1.51	2.44	1.64	1.06	**	1.21	1.03	2.62
Benzaldehyde	0.061	0.045	0.025	0.02	0.086	0.03	0.018	0.048	0.036	0.025	**	0.014	0.078	0.04
Butyr/Isobutyraldehyde	0.107	0.114	0.102	0.071	0.119	0.05	0.104	0.138	0.107	0.09	**	0.051	0.06	0.131
Crotonaldehyde	0.284	0.074	0.076	0.018	0.034	0.016	0.064	0.04	0.059	0.033	**	0.014	0.02	0.063
Formaldehyde	2.75	1.32	1.61	1.17	0.989	0.601	1.19	1.56	1.61	1.22	**	0.378	1.01	1.8
Hexaldehyde	0.04	0.052	0.033	0.018	0.031	0.015	0.033	0.055	0.033	0.021	**	0.015	0.018	0.036
Isovaleraldehyde	0.03	0.065	0.053	0.023	0.071		0.031	0.058		0.018	**		0.025	0.016
Propionaldehyde	0.095	0.084	0.061	0.03	0.06	0.039	0.1	0.141	0.129	0.084	**	0.051	0.062	0.155
Tolualdehydes	0.039	0.04	0.015	0.013	0.02	0.013	0.028	0.049	0.037	0.014	**	0.008	0.014	0.036
Valeraldehyde	0.034	0.03	0.026	0.025	0.023	0.01	0.02	0.033	0.023	0.02	**	0.01	0.015	0.025

Hazardous Air Pollutants, Loudon County, Tennessee, March 11, 2005 – August 26, 2005

Compound (ppbv)	3/11/2005	3/23/2005	4/4/2005	4/16/2005	4/28/2005	5/10/2005	5/22/2005	6/15/2005	6/27/2005	7/9/2005	7/21/2005	8/2/2005	8/14/2005	8/26/2005
Canister Results														
1,1,1-Trichloroethane										0.02	0.02	***	0.02	0.03
1,1,2,2-Tetrachloroethane											0.03	***		
1,1,2-Trichloroethane												***		
1,1-Dichloroethane												***		
1,1-Dichloroethene												***		
1,2,4-Trichlorobenzene												***	0.03	
1,2,4-Trimethylbenzene	0.07	0.11	0.15		0.13	0.21			0.15	0.11	1.03	***	0.11	0.2
1,2-Dibromoethane												***		
1,2-Dichloroethane											0.03	***		
1,2-Dichloropropane												***		
1,3,5-Trimethylbenzene					0.04	0.07			0.06	0.03	0.3	***	0.03	0.05
1,3-Butadiene					0.06					0.04	0.16	***	0.02	0.04
Acetonitrile	*Note	*Note			0.37						3.45	***		
Acetylene	0.83	0.93	1.46	1.33	1.03	1.2	0.67	0.34	0.75	1.09	2.95	***	0.89	0.86
Acrolein (Added New July 2005)											0.98	***		
Acrylonitrile												***		
Benzene	0.31	0.42	0.49	0.36	0.31	0.54	0.32	0.19	0.38	0.35	0.89	***	0.25	0.4
Bromochloromethane											0.11	***		
Bromodichloromethane												***		
Bromoform												***		
Bromomethane										0.01	0.02	***	0.01	0.04
Carbon Tetrachloride		0.1	0.1		0.1	0.1	0.1	0.14	0.09	0.1	0.09	***	0.13	0.09
Chlorobenzene											0.05	***		
Chloroethane										0.05	0.02	***	0.02	0.02
Chloroform			0.1	0.07	0.05	0.21	0.06		0.09	0.06	0.22	***	0.07	0.06
Chloromethane	0.59	0.74	0.59	0.64	0.73	0.65	0.7	0.53	0.74	0.66	0.9	***	0.9	0.7
Chloromethylbenzene												***		
Chloroprene												***		
cis-1,2-Dichloroethylene												***		
cis-1,3-Dichloropropene												***		
Dibromochloromethane												***		
Dichlorodifluoromethane	0.57	0.62	0.53	0.64	0.67	0.64	0.63	0.77	0.61	0.59	0.9	***	0.76	0.61
Dichloromethane	0.14	0.1	0.1		0.19	0.09				0.08	1.15	***	0.09	0.15
Dichlorotetrafluoroethane										0.02	0.08	***		0.02
Ethyl Acrylate												***		

Hazardous Air Pollutants, Loudon County, Tennessee, March 11, 2005 – August 26, 2005, continued

Compound (ppbv)	3/11/2005	3/23/2005	4/4/2005	4/16/2005	4/28/2005	5/10/2005	5/22/2005	6/15/2005	6/27/2005	7/9/2005	7/21/2005	8/2/2005	8/14/2005	8/26/2005
Ethyl tert-Butyl Ether												***		
Ethylbenzene	0.06	0.09	0.17	0.13	0.29	0.2	0.12		0.14	0.12	1.5	***	0.12	0.19
Hexachloro-1,3-Butadiene												***		
m,p-Xylene	0.17	0.27	0.41	0.32	0.86	0.47	0.27	0.1	0.32	0.26	4.51	***	0.27	0.43
m-Dichlorobenzene												***	0.01	
Methyl Ethyl Ketone			0.63	0.67	0.34	0.27	0.37			1.23	3.15	***		1.3
Methyl Isobutyl Ketone					0.11					0.07	0.96	***		0.2
Methyl Methacrylate											0.08	***		
Methyl tert-Butyl Ether										0.06		***		
n-Octane					0.12						0.13	***		0.05
o-Dichlorobenzene												***	0.01	
o-Xylene	0.06	0.11	0.19	0.14	0.43	0.21	0.11	0.04	0.16	0.12	1.22	***	0.13	0.2
p-Dichlorobenzene					0.06	0.11				0.05	0.38	***	0.06	0.05
Propylene	0.25	0.33	0.46	0.43	0.43	0.47	0.22	0.14	0.39	0.55	1.12	***	0.4	0.46
Styrene		0.2	0.09	0.11	0.37	0.16			0.24	0.14	1.85	***	0.05	0.12
tert-Amyl Methyl Ether												***		
Tetrachloroethylene											0.6	***		0.03
Toluene	0.34	0.51	1.48	1.05	3.02	1.25	0.87	0.2	1.02	0.91	22.8	***	0.79	1.71
trans-1,2-Dichloroethylene												***		
trans-1,3-Dichloropropene												***		
Trichloroethylene											0.23	***	0.02	0.02
Trichlorofluoromethane	0.27	0.3	0.26	0.3	0.31	0.31	0.27	0.38	0.29	0.28	0.49	***	0.41	0.29
Trichlorotrifluoroethane	0.11	0.1	0.08	0.09	0.09	0.1	0.08	0.14	0.14	0.09	0.08	***	0.13	0.14
Vinyl Chloride					0.04						0.02	***		0.01
Cartridge Results														
2,5-Dimethylbenzaldehyde	0.01													
Acetaldehyde	0.769	0.53	2.28	1.65	0.79	2	0.999	1.15	1.36	1.15	1.34	1.5	0.816	1.64
Acetone	0.969	0.939	2.1	2.06	0.996	1.41	0.816	0.711	0.428	0.759	0.028	0.784	0.685	0.638
Benzaldehyde	0.02	0.019	0.051	0.053	0.064	0.087	0.036	0.024	0.072	0.052	0.031	0.1	0.016	0.023
Butyr/Isobutyraldehyde	0.008	0.056	0.21	0.158	0.074	0.158	0.088	0.083	0.088	0.112	0.102	0.117	0.057	0.094
Crotonaldehyde	0.017	0.012	0.038	0.033	0.031	0.15	0.298	0.541	0.591	0.596	0.672	0.592	0.534	0.429
Formaldehyde	0.641	0.68	1.87	1.83	0.941	2.81	2.31	3.12	3.4	3.87	3.93	4.05	2.51	2.48
Hexaldehyde	0.067	0.016	0.076	0.06	0.033	0.085	0.035	0.031	0.052	0.038	0.023	0.039	0.035	0.069
Isovaleraldehyde	0.079	0.028	0.087	0.054	0.012	0.078	0.024		0.06	0.049	0.094	0.044	0.022	0.054
Propionaldehyde	0.058	0.052	0.108	0.161	0.081	0.18	0.094	0.111	0.107	0.136	0.107	0.136	0.097	0.139
Tolualdehydes	0.016	0.012		0.023	0.015	0.044	0.031	0.059	0.143	0.039	0.037	0.033	0.038	0.024
Valeraldehyde	0.012	0.026	0.063	0.045	0.025	0.058	0.024	0.027	0.03	0.035	0.036	0.038	0.025	0.033

Hazardous Air Pollutants, Loudon County, Tennessee, September 7, 2005 – December 24, 2005

Compound (ppbv)	9/7/2005	9/9/2005	9/19/2005	10/4/2005	10/13/2005	10/25/2002	11/6/2005	11/18/2005	11/30/2005	12/12/2005	12/24/2005	Average
Canister Results												
1,1,1-Trichloroethane	***		0.03	0.02	***	0.03	0.02	0.03	0.02	0.03		0.03
1,1,2,2-Tetrachloroethane	***				***							0.03
1,1,2-Trichloroethane	***				***							
1,1-Dichloroethane	***				***							
1,1-Dichloroethene	***				***							
1,2,4-Trichlorobenzene	***		0.05		***	0.07		0.02				0.04
1,2,4-Trimethylbenzene	***		0.14	0.07	***	0.04	0.05	0.09	0.04		0.07	0.18
1,2-Dibromoethane	***				***							
1,2-Dichloroethane	***				***							0.03
1,2-Dichloropropane	***				***							
1,3,5-Trimethylbenzene	***		0.04	0.02	***	0.02	0.02	0.02	0.02	0.01	0.02	0.07
1,3-Butadiene	***		0.04	0.04	***	0.02	0.02	0.05	0.03	0.02	0.08	0.05
Acetonitrile	***				***						0.24	65.95
Acetylene	***		0.87	0.95	***	0.35	0.61	0.9	0.54	0.64	1.79	0.93
Acrolein (Added New July 2005)	***				***	0.43				0.45		0.62
Acrylonitrile	***				***							0.32
Benzene	***		0.42	0.43	***	0.15	0.21	0.32	0.21	0.19	0.4	0.38
Bromochloromethane	***				***							0.11
Bromodichloromethane	***				***							
Bromoform	***				***							
Bromomethane	***		0.01	0.02	***	0.01	0.01	0.01	0.01		0.01	0.02
Carbon Tetrachloride	***		0.11	0.13	***	0.09	0.09	0.12	0.09	0.12	0.11	0.09
Chlorobenzene	***				***							0.05
Chloroethane	***		0.02	0.02	***	0.01	0.01	0.01	0.01		0.01	0.06
Chloroform	***		0.28	0.2	***	0.05	0.03	0.04	0.09	0.03	0.06	0.10
Chloromethane	***		0.63	0.81	***	0.53	0.63	0.54	0.56	0.65	0.63	0.63
Chloromethylbenzene	***				***							
Chloroprene	***				***							
cis-1,2-Dichloroethylene	***				***							
cis-1,3-Dichloropropene	***				***							
Dibromochloromethane	***				***							
Dichlorodifluoromethane	***		0.61	0.71	***	0.61	0.57	0.75	0.62	0.81	0.76	0.61
Dichloromethane	***		0.07	0.15	***	0.04	0.09	0.05	0.09	0.13	0.07	0.17
Dichlorotetrafluoroethane	***		0.02	0.02	***	0.02	0.02	0.02	0.02	0.02	0.02	0.03
Ethyl Acrylate	***				***							

Hazardous Air Pollutants, Loudon County, Tennessee, September 7, 2005 – December 24, 2005, continued

Compound (ppbv)	9/7/2005	9/9/2005	9/19/2005	10/4/2005	10/13/2005	10/25/2005	11/6/2005	11/18/2005	11/30/2005	12/12/2005	12/24/2005	Average	
Ethyl tert-Butyl Ether	***				***								
Ethylbenzene	***		0.13	0.08	***	0.04	0.06	0.08	0.05	0.04	0.08	0.14	
Hexachloro-1,3-Butadiene	***		0.03		***	0.03		0.01		0.02	0.02	0.02	
m,p-Xylene	***		0.32	0.16	***	0.09	0.12	0.2	0.1	0.09	0.19	0.35	
m-Dichlorobenzene	***				***	0.02		0.02				0.02	
Methyl Ethyl Ketone	***			0.75	***					0.09		1.90	
Methyl Isobutyl Ketone	***		0.04		***			0.06				0.85	
Methyl Methacrylate	***				***							0.08	
Methyl tert-Butyl Ether	***				***							0.16	
n-Octane	***		0.04		***	0.06	0.03		0.02	0.14	0.03	0.16	
o-Dichlorobenzene	***		0.02		***	0.01						0.01	
o-Xylene	***		0.16	0.08	***	0.05	0.06	0.1	0.05	0.04	0.09	0.15	
p-Dichlorobenzene	***		0.04	0.03	***	0.03	0.02	0.03	0.02	0.01	0.02	0.06	
Propylene	***		0.41	0.46	***	0.18	0.11	0.58	0.29	0.26	0.74	0.38	
Styrene	***		0.44	0.25	***	0.08	0.04	0.11	0.09	0.03	0.05	0.21	
tert-Amyl Methyl Ether	***				***								
Tetrachloroethylene	***		0.02	0.03	***	0.01			0.02		0.01	0.09	
Toluene	***		1.02	0.65	***	0.36	0.46	0.62	0.42	0.36	0.65	1.17	
trans-1,2-Dichloroethylene	***				***								
trans-1,3-Dichloropropene	***				***							0.11	
Trichloroethylene	***		0.02		***		0.01	0.02			0.01	0.05	
Trichlorofluoromethane	***		0.29	0.35	***	0.27	0.27	0.38	0.33	0.4	0.36	0.33	
Trichlorotrifluoroethane	***		0.15	0.12	***	0.14	0.09	0.13	0.11	0.16	0.17	0.13	
Vinyl Chloride	***				***							0.02	
Cartridge Results													
2,5-Dimethylbenzaldehyde	***				***							0.03	Avg since 4/18/04
Acetaldehyde	***		1.48	1.21	***	0.324	1.52	1.41	0.543	0.598	1.35	1.62	1.24
Acetone	***		1.07	1.22	***	0.722	1.02	1.61	1.36	0.746	0.01	1.73	
Benzaldehyde	***		0.095	0.092	***	0.017	0.021	0.039	0.023	0.015	0.032	0.09	
Butyr/Isobutyraldehyde	***		0.121	0.112	***	0.036	0.139	0.121	0.066	0.062	0.244	0.84	
Crotonaldehyde	***		0.402	0.255	***	0.017	0.055	0.04	0.025	0.019	0.118	0.18	Avg since 4/18/04
Formaldehyde	***		3.32	2.62	***	0.524	1.91	0.954	0.895	0.754	1.48	6.11	2.02
Hexaldehyde	***		0.099	0.086	***	0.021	0.059	0.036	0.016	0.025	0.034	0.57	
Isovaleraldehyde	***				***		0.083	0.056		0.023	0.04	0.06	
Propionaldehyde	***		0.142	0.154	***	0.042	0.121	0.11	0.074	0.062		0.12	
Tolualdehydes	***		0.044	0.046	***	0.027	0.024	0.047	0.013	0.022	0.022	0.12	
Valeraldehyde	***		0.041	0.039	***	0.01	0.028	0.017	0.015	0.019	0.032	0.17	

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Appendix B

Additional Data on Sources of Environmental Pollution

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Toxic Release Inventory (TRI)

The Toxics Release Inventory (TRI) is a publicly available EPA database that contains information on toxic chemical releases and other waste management activities reported annually by certain covered industry groups as well as federal facilities. This inventory was established under the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) and expanded by the Pollution Prevention Act of 1990.

TRI data are collected in the first year, analyzed in the second year, and then released the following year. That means that all TRI data are least 2 years old when available. Sometimes the most recent data set will be 3 years old as extra time is necessary to produce particular statistics. Year 2001 TRI data presented by Scorecard (*www.scorecard.org*) and year 2002 data compiled with Tri-Explorer (TRI 2004a) were used in compiling the data presented here. Unless noted, "releases" refers to total on- and off-site disposal or other releases, such as wells, RCRA landfills, fugitive air emissions, point source air emissions, land treatment, surface water discharges, publicly owned treatment works (POTWs), solidification, waste water treatment, storage, land disposal, surface impoundments, and transfers to waste brokers for disposal.

The TRI Program has given the public unprecedented direct access to toxic chemical disposal or other release and other waste management data at the local, state, regional, and national level. Use of this information can enable the public to identify potential concerns, gain a better understanding of potential risks, and work with industry and government to reduce toxic chemical use, disposal or other releases and the risks associated with them. When combined with hazard and exposure data, this information can allow informed environmental priority-setting at the local level.

Federal, state, and local governments can use the data to compare facilities or geographic areas, to identify hot spots, to evaluate existing environmental programs, to more effectively set regulatory priorities, and to track pollution control and waste reduction progress. TRI data, in conjunction with demographic data, can help government agencies and the public identify potential environmental justice concerns. Industry can use the data to obtain an overview of the disposal, release, and other management of toxic chemicals, to identify and reduce costs associated with toxic chemicals in waste, to identify promising areas of pollution prevention, to establish reduction targets, and to measure and document progress toward reduction goals. Public availability of the data has prompted many facilities to work with communities to develop effective strategies for reducing environmental and potential human health risks posed by disposal or other releases and other waste management of toxic chemicals.

While TRI provides the public, industry, and state and local governments an invaluable source of key environmental data, it has some limitations that must be considered when using the data. TRI data reflect chemical management practices, not exposures of the public to those chemicals. The data are generally not sufficient by themselves to determine exposure or to calculate potential adverse effects on human health and the environment. TRI data can be used to identify areas of potential concern. TRI data, in conjunction with other information, can be used as a starting point in evaluating exposures. The determination of potential risk depends upon many factors, including the toxicity of the chemical, the fate of the chemical in the environment, the locality, and the human and other populations that are exposed to the chemical after its disposal or release.

Key factors to consider when using the data include:

- Toxicity varies among the covered chemicals; data on the amounts of the chemicals present alone are inadequate to reach conclusions or formulate policy;
- The presence of a chemical in the environment must be evaluated along with the potential and actual exposures and the route of exposures, the chemical's fate in the environment, and other factors, before any statements can be made about potential risks associated with the chemical or a release;
- Many options for managing production-related wastes are subject to stringent technical standards and exacting state and federal regulatory oversight;
- Regulatory controls apply to many of the releases reported that are production related; reporting facilities must comply with environmental standards and also report residual releases; and
- Some reporters send chemicals off-site in waste to be managed at specialized waste management facilities that are also reporters; adjustments must be made to avoid double counting (TRI 2004b).

Even with expanded industry coverage since the 1998 reporting year, TRI does not address all sources of disposal or other releases and other waste management activities of TRI chemicals. Although the EPA has expanded the number of industries that must report and has added persistent, bioaccumulative, toxic (PBT) chemicals to the section 313 list of toxic chemicals, the program does not cover all sources of TRI chemicals or any sources of non-TRI chemicals. Although TRI is successful in capturing information on a significant portion of toxic chemicals currently being used by covered industry sectors, it does not cover all toxic chemicals or all industry sectors. In addition, even within covered SIC codes, facilities that manage listed TRI chemicals but do not meet the TRI threshold levels (those with fewer than 10 full-time employees or those not meeting TRI quantity thresholds) are not required to report even though they may release toxic chemicals into the environment. Thus, while the TRI includes 93,380 reports from 4,379 facilities for 2002, the 4.79 billion pounds of on-and off-site disposal or other releases reported represent only a portion of all toxic chemical disposal or other releases nationwide. The TRI does not include data on toxic emissions from cars and trucks, nor from the majority of sources of releases of pesticides, volatile organic compounds, fertilizers or from many other non- industrial sources.

Also, while many facilities base their TRI emissions on monitoring data, others report estimated data, as the program does not mandate monitoring. Various estimation techniques can be used when monitoring data are not available, and EPA has published estimation guidance for the regulated community. Variations between facilities can result from the use of different estimation methodologies. These factors should be taken into account when considering data accuracy and comparability.

The following table lists the TRI chemicals released into the air in Loudon County as reported in the 2002 TRI data. Fugitive emissions are those not caught by a capture system, that is, they are not point sources.

Toxic Release Inventory (TRI) On-site and Off-site Reported Disposed of or Otherwise Released Total Chemicals (in pounds) for Facilities in All Industries, Loudon County, Tennessee, 2002.			
Facility & Chemicals	**Fugitive Air Emissions**	**Point Source Air Emissions**	**Total On- & Off-site Disposal or Other Releases**
Tate and Lyle	**42,971**	**390,121**	**433,435**
Acetaldehyde	40,600	53,720	94,325
Benzo (GHI) Perylene	0	3	3
Dioxin and Dioxin-Like Compounds	0	0.0004	0.0004
Hydrochloric Acid (1995 & after “Acid Aerosols” only)	5	249,270	249,275
Hydrogen Fluoride	0	30,168	30,168
Lead Compounds	0	55	65
Mercury Compounds	0	2	25
Methanol	2,200	22,000	24,205
n-Hexane	166	0	166
Nitrate Compounds	0	0	300
Polycyclic Aromatic Compounds	0	40	40
Sulfuric Acid (1994 & after “Acid Aerosols” only)	0	34,863	34,863
Acupowder TN LLC	**27,651**	**250**	**28,151**
Copper	27,580	0	27,830
Manganese	71	250	321
IMCO Recycling	**0**	**2,200**	**112,213**
Aluminum (Fume or Dust)	0	2,200	112,200
Copper	NA	NA	NA
Dioxin and Dioxin-like Compounds	0	0.001	0.1
Lead	0	0	13
Manganese	NA	NA	NA
Kimberly-Clark	**NA**	**NA**	**NA**
Ammonia	NA	NA	NA
Malibu Boats West Inc.	**76,614**	**51,076**	**127,690**
Styrene	76,614	51,076	127,690
Strongwell	**27,055**	**485**	**27,540**
Styrene	27,055	485	27,540
Viskase Corp	**90,000**	**2,201,142**	**2,291,539**
Carbon Disulfide	90,000	2,170,000	2,260,000
Hydrochloric Acid (1995 & after “Acid Aerosols” only)	0	31,000	31,000
Lead Compounds	0	142	539
Vytron Corp	**0**	**250**	**1,650**
Di(2-Ethylhexl)Phthalate	0	250	1,650
Yale Security INC	**45**	**45**	**7,981**
Chromium Compounds	10	10	3,103
Copper Compounds	10	10	860
Lead Compounds	5	5	89
Nickel Compounds	10	10	3,092
Zinc Compounds	10	10	837

The following table ranks producers in the order of total annual fugitive and point source air emissions based on 2002 TRI data. The next table presents these industries in the order of total on- and off-site disposal or other releases.

Rank Order TRI Fugitive and Point Source Air Emissions (in pounds) for All Chemicals, Facilities in All Industries, Loudon County, Tennessee, 2002.

Rank Order in Loudon County	Facility	Fugitive + Point Source Air Emissions
1	Viskase Corporation	2,291,142
2	Tate and Lyle	433,092
3	Malibu Boats West Inc.	127,690
4	Acupowder TN LLC	27,901
5	Strongwell	27,540
6	IMCO Recycling	2,200
7	Vytron Corp	250
8	Yale Security INC	90
9	Kimberly-Clark	NA

Rank Order TRI Total On-site and Off-site Reported Disposal of or Otherwise Released Total Chemicals (in pounds) for Facilities in All Industries, Loudon County, Tennessee, 2002.

Rank Order in Loudon County	Facility	Fugitive + Point Source Air Emissions
1	Viskase Corporation	2,291,539
2	Tate and Lyle	433,435
3	Malibu Boats West Inc.	127,690
4	IMCO Recycling	112,213
5	Acupowder TN LLC	28,151
6	Strongwell	27,540
7	Yale Security Inc.	7,981
8	Vytron Corp	1,650
9	Kimberly-Clark	NA

Four of the industries in Loudon County rank in the Top 100 TRI chemicals released directly to Tennessee air. These companies and their statewide rank are listed in the following table.

Industries in Loudon County in the Top 100 TRI chemical emissions to the air in Tennessee, 2001.

Rank in Tennessee	Facility	Total Pounds of TRI Chemicals Released to Air
10	Viskase Corporation	2,268,148
28	Tate and Lyle	530,784
57	Acupowder TN LLC	155,542
68	Malibu Boats West Inc.	112,736

Waste Water

Most area industries pre-treat their industrial discharges and send the treated wastes to either the Tellico Reservoir Development Agency (TRDA) Sewage Treatment Plant (STP) or the Loudon STP. Both treatment plants have valid National Pollutant Discharge Elimination System (NPDES) permits. The TRDA STP discharges to the Little Tennessee River at mile 16.1, while the Loudon STP discharges into Watts Bar Lake at Tennessee River mile 591.6. Kimberly-Clark Corporation has an industrial NPDES permit for discharge to the Tennessee River at river mile 589.7. Kimberly-Clark is in compliance with its permit limits. Viskase Corporation has an NPDES permit, although it has no discharge. In November 2003 the Knoxville News Sentinel published a notice that ArvinMeritor Corporation, Praxair Corporation, and Continental Carbonics Corporation were "in significant noncompliance for chronic and technical review criteria violations of the Loudon Sewer Use Ordinance . . . for all of 2003" (Lutrell 2003).

Hazardous Waste

Loudon County has no Superfund National Priorities List (NPL) sites, nor any known hazardous waste generator sites (Resource Conservation and Recovery Act (RCRA)) that are contaminated. One hazardous waste generator (RCRA) site in Lenoir City is undergoing remediation. An NPL site is generally larger than a state superfund site and has more potential to expose local communities to toxic chemicals. Lenoir City Car Works and Greenback Industries are two state superfund sites in Loudon County.

Water Quality Issues

Several streams, rivers, and reservoirs in Loudon County fail to meet State water quality standards. These are listed in the Final 2002 303(d) List, published by TDEC, Division of Water Pollution Control, along with the cause for not meeting standards and the source of each pollutant not meeting standards. In 2002, two water-bodies were delisted, that is, taken off the list. See the next table for details.

Year 2002 303(d) List of Streams and Lakes That Are Water-Quality Limited [1]. Loudon, County, Tennessee. (TDEC Division of Water Pollution Control 2004)

River Basin	Waterbody	Cause for listing/delisting	Source of pollutant/comments
Upper Tennessee	Upper Watts Bar Reservoir	PCBs in sediment Dissolved oxygen	Fishing advisory due to PCBs. Provides habitat for the federally listed fish [2], snail darter (Percina tanasi) and the following mussels: orange-foot pimpleback pearly mussel Plethobasus cooperianus) and pink mucket pearly mussel (Lampsilis abrupta). Upstream impoundment
Upper Tennessee	Mud Creek	Pathogens	Pasture Grazing
Upper Tennessee	Greasy Branch	Pathogens	Pasture Grazing
Upper Tennessee	Pond Creek	Pathogens/nutrients	Pasture Grazing
Upper Tennessee	Sweetwater Creek	Siltation	Channelization/pasture grazing/land development
Upper Tennessee	Sweetwater Creek (delisted)	Priority Organics/Arsenic/ Copper/Chromium	The contaminated sediment was removed from the stream near a CERCLA cleanup site. The implementation of this control strategy has eliminated the source of priority organics, copper, and chromium. (The stream will remain listed for siltation.)
Upper Tennessee	Fort Loudon Reservoir	PCBs in sediment	Fishing advisory due to PCBs.
Upper Tennessee	Fort Loudon Reservoir (delisted)	Urban Runoff/ Storm Sewers	Original listing was in error
Upper Tennessee	Town Creek	Habitat alteration	Pasture grazing/land development/hydromodification
Upper Tennessee	Steekee Creek	Habitat alteration	Pasture grazing
Upper Tennessee	Floyd Creek	Siltation/Pathogens	Pasture grazing
Upper Tennessee	Cloyd Creek	Siltation/Habitat alteration/Pathogens	Pasture grazing/livestock in stream
Little Tennessee	Tellico Reservoir	PCBs in sediment	Fishing advisory-PCBs in catfish. The Tellico River was habitat for the federally listed snail darter (Percina tanasi). However, there are no records of this species post-impoundment.
Little Tennessee	Fork Creek	Nitrates/Siltation/ Pathogens	Pasture grazing
Little Tennessee	Baker Creek	Pathogens	Pasture grazing

[1] *does not meet one or more standards*
[2] *either threatened or endangered*

Appendix C

Hazardous Air Pollutants Not Identified as Chemicals of Concern

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Acetonitrile

Acetonitrile is used as a starting material for the production of nitrogen-containing compounds as well as for extraction of fatty acids from fish liver oils, oils from other animals, and vegetable oils. It is widely used in industrial settings as a solvent and in many other industrial processes [HSDB]. Acetonitrile is a component of environmental tobacco smoke; the concentration is estimated to be about 7.0 micrograms per cubic meter ($\mu g/m^3$) (Miller 1998). Chronic inhalation exposure of humans to acetonitrile results in cyanide poisoning from metabolic release of cyanide after absorption. The major effects consist of those on the central nervous system (CNS), such as headaches, numbness, and tremor.

EPA has derived a Reference Dose (RfC) for acetonitrile of60 $\mu g/m^3$ or 36 parts per billion (ppb) based on the no observed adverse effect level (NOAEL) in mouse subchronic and chronic inhalation studies [IRIS]. This level is expected to be safe for a lifetime exposure. The RfC is not a direct estimator of risk but rather a reference point to gauge the potential effects. At exposures increasingly greater than the RfC, the potential for adverse health effects increases. Lifetime exposure above the RfC does not imply that an adverse health effect would necessarily occur. EPA has assigned acetonitrile as a class D carcinogen, not classifiable as to human carcinogenicity. There is an absence of human evidence and the animal evidence is equivocal.

The mean concentration of acetonitrile measured at the HAPs monitor in Loudon was 1.75 ppb for analysis of samples taken on April 18, April 21, May 3, May 15, May 27, June 8, and July 26, 2004. Sampling and analysis for this chemical has been difficult. Acetonitrile was used in the manufacture of the cartridge and subsequently bled into the canister, adding acetonitrile that was not present in the ambient air to the sample for analysis. This occurred with the sampling device in Dickson County, which was bought at the same time as the device used in Loudon County. The problem has also appeared in the equipment used in Kingsport. Because the sampling results are not reliable, no statements can be made about the health hazard since concentrations are unknown.

Acetylene

Acetylene is a simple asphyxiant. Inhalation of 100,000,000 parts per billion (ppb) may cause a slightly intoxicating effect. There is no evidence that repeated exposure to tolerable levels has any deleterious effects on health. Chronic systemic inhalation causes readily reversible changes which disappear after end of exposure (HSDB).

The mean concentration of acetylene measured at the HAPs monitor in Loudon was 0.88 ppb from November 15, 2003 through December 23, 2004. There should be no health hazard to exposure to this level of acetylene.

Aldehydes

All the aldehydes possess anesthetic properties, but this is obscured by their highly irritant action on the eyes & mucous membranes of the respiratory tract.

Benzaldehyde

Benzaldehyde is used as a chemical intermediate in the manufacture of dyes, odorants, and flavoring chemicals. It is also used directly as a flavoring agent for artificial cherry and almond flavors and as a solvent for oils, resins, and cellulose fibers (HSDB). Benzaldehyde is released to the environment in emissions from combustion processes such as gasoline and diesel engines, incinerators and wood burning. It is formed in the atmosphere through photochemical oxidation of toluene and other aromatic hydrocarbons. It occurs naturally in various plants. If released to the atmosphere, benzaldehyde has a half-life of about 29.8 hours. Rain can remove benzaldehyde from the air. If released to soil or water, the major degradation pathway is expected to be biodegradation.

Occupational exposure to benzaldehyde occurs through inhalation of vapor and dermal contact. Benzaldehyde's use as a flavoring agent and its natural occurrence in many foods will expose the general population through oral consumption. The general population is also exposed to benzaldehyde through its occurrence in ambient air (HSDB). Inhalation of concentrated vapor may irritate the eyes, nose, and throat, especially when in a liquid form. Prolonged contact with the skin may cause irritation, but no other adverse health outcomes are known.

Concentrations of benzaldehyde found in ambient outdoor and indoor air range from 0.1 ppb to 15.6 ppb in the U.S (HSDB).

The mean concentration of benzaldehyde measured at the HAPS monitor in Loudon was 0.13 ppb from November 15, 2003 through December 23, 2004. This level of benzaldehyde is not expected to present a health hazard.

Butyraldehyde and Isobutyraldehyde

Butyraldehyde and isobutyraldehyde are transparent, colorless liquids with an extremely sharp, pungent odor and fruity taste. It is used as in the manufacture of rubber accelerators, synthetic resins, solvents, and plasticizers, as well as a synthetic flavoring in foods. Isobutyraldehyde is used in the synthesis of cellulose esters, perfumes, flavors, gasoline additives, and amino acids and is used as a food additive permitted for direct addition to food for human consumption as a synthetic flavoring substance. Isobutyraldehyde is emitted into the atmosphere by combustion sources and occurs naturally in foods; it is also emitted into the atmosphere by plants. Isobutyraldehyde will be degraded in the atmosphere with a half-life between 2.5 hours and 14.6 hours. Butyraldehyde will degrade in 16.4 hours (HSDB).

Occupational exposure to butyraldehyde and isobutyraldehyde may occur through inhalation and dermal contact. Monitoring data indicate that the general population may be exposed to isobutryaldehyde through consumption of food (since it occurs naturally in many foods) and consumption of drinking water. People may be exposed to butyraldehyde in ambient air. While butyraldehyde and isobutyraldehyde can be irritating to the skin and eyes, they are not associated with any significant or long term adverse health effects.

Concentrations of butyraldehyde found in ambient air range from 0.15 ppb to 7.3 ppb in the U.S (HSDB).

The mean concentration of butyraldehyde and isobutyraldehyde measured at the HAPS monitor in Loudon was 1.38 ppb from November 15, 2003 through December 23, 2004. This is not expected to be a health hazard.

Crotonaldehyde

The general population may be exposed to crotonaldehyde through inhalation of tobacco smoke, gasoline and diesel engine exhausts, and wood combustion.

Atmospheric source of crotonaldehyde include exhausts from both gasoline and diesel engines. It was present at concentrations ranging from 100-1,330 ppb in automobile exhaust gas. Six sites along US Highway 70 near Raleigh, North Carolina, during May 1983 (collection of samples from 7:30-8:30 AM) had crotonaldehyde at concentrations ranging from 2.17-3.71 percent of total carbon collected. Forty-six in-use light-duty gasoline vehicles were monitored for total aldehyde levels and non-methane hydrocarbon concentrations; under conditions of congested city driving crotonaldehyde was 4.19% of the total carbon measured. Under conditions of commuter traffic, crotonaldehyde was 3.53% of the total carbon measured; under rush-hour expressway driving conditions, this compound represented 3.12% of the total carbon measured. Crotonaldehyde was present at 0.12% and 0.03% by weight of total organic gas emissions for non-catalyst and catalyst gasoline engine exhaust, respectively. In addition, crotonaldehyde concentrations of 6-116 milligrams per kilogram (ppb) were detected in emissions from wood burning fireplaces. A wood fireplace emitted from non-detectable levels to 23 mg crotonaldehyde per minute. Sidestream smoke from burning cigarettes contained 280 ug crotonaldehyde per cigarette (HSDB).

Occupational exposure via inhalation and dermal contact is possible at sites of its commercial production and use.

As a strong lacrimatory agent, crotonaldehyde can irritate tissues of the nose, pharynx, and larynx. In addition, no other adverse health consequences are known.

The mean concentration of crotonaldehyde measured at the HAPS monitor in Loudon was 0.155 ppb from November 15, 2003 through December 23, 2004. This is not expected to present a health hazard.

2,5-Dimethylbenzaldehyde

No information available.

The mean concentration of 2,5-dimethylbenzaldehyde measured at the HAPS monitor in Loudon was 0.04 ppb from November 15, 2003 through July 26, 2004. This aldehyde was measured sporadically and is not expected to present a health hazard.

Hexaldehyde

Hexaldehyde (also called hexanal) is a colorless liquid with a characteristic fruity odor on dilution. It is reported to be found naturally in apple, strawberry, camphor oil, tea extracts, tobacco leaves, eucalyptus globulus, dwarf pine, bitter orange, coffee, cocoa, lemon, and orange. Hexaldehyde is released to the environment through various waste streams from its production and use as a food additive (flavor ingredient), in organic synthesis of plasticizers, rubber chemicals, dyes, synthetic resins, and insecticides, and in perfumery (at low concentrations). If released to the atmosphere, hexaldehyde will exist in the vapor phase and will be degraded in the atmosphere by reaction with photochemically produced hydroxyl radicals with an estimated half-life of about 13 hours. Hexaldehyde is also degraded in the atmosphere by reaction with nitrate radicals with an estimated half-life of 3.4 years. The general population will be exposed to hexaldehyde via inhalation of ambient air, ingestion of food and drinking water, and dermal contact with vapors, food and other products containing it. Occupational exposure may be through inhalation and dermal contact (HSDB). The vapor is irritating the eyes, nose, and throat. It has been measured in diesel exhaust at 200 ppb.

Hexaldehyde has been found in ambient air in Europe, ranging from 0.11 ppb to 1.75 ppb (HSDB).

The mean concentration of hexaldehyde measured at the HAPS monitor in Loudon was 0.957 ppb from November 15, 2003 through July 26, 2004. This is not expected to present a health hazard.

Isovaleraldehyde

Isovaleraldehyde may be released to the environment through its production and use as a flavoring, in perfumes, in pharmaceuticals, and in synthetic resins. If released to the atmosphere, isovaleraldehyde will exist in the vapor phase. Vapor-phase isovaleraldehyde is degraded in the atmosphere by reaction with photochemically produced hydroxyl radicals with an estimated half-life of about 14 hours.

The general population will be exposed to isovaleraldehyde via inhalation of ambient air, ingestion of food and drinking water, and dermal contact with vapors, food, and other products containing isovaleraldehyde. Occupational exposure may be through inhalation and dermal contact with the compound (HSDB).

Isovaleraldehyde occurs naturally in orange, lemon, eucalyptus, and other oils. It is a component of exhaust of internal combustion engines.

Isovaleraldehyde has been found in air at average concentrations of 0.22 ppb on a busy street in Stockholm, 0.04 ppb on another busy street in Stockholm, 0.05 ppb at a small island in Stockholm, 0.04 on a calm street in Stockholm, and 0.05 ppb at a recreation area, 12 km from Stockholm.

The mean concentration of isovaleraldehyde measured at the HAPS monitor in Loudon was 0.07 ppb from November 15, 2003 through December 23, 2004. This concentration is not expected to present a health hazard.

Propionaldehyde

Propionaldehyde's production and use in the manufacture of propionic acid, plastics, rubber chemicals, and as a disinfectant and preservative may result in its release to the environment through various waste streams. Propionaldehyde is released to the atmosphere via the combustion of wood, gasoline, diesel fuel, and polyethylene. Municipal waste incinerators can release it to ambient air (HSDB).

The vapor may cause respiratory irritation but is not a strong enough irritant of eyes or respiratory tract to be considered significant factor in smog.

Propionaldehyde has been found in concentrations ranging from 0.2 ppb to 39.9 ppb in ambient air in the U.S. (HSDB).

The mean concentration of propionaldehyde measured at the HAPS monitor in Loudon was 0.13 ppb from November 15, 2003 through December 23, 2004. This level is not expected to present a health hazard.

Tolualdehydes

Tolualdehyde, also known as methylbenzaldehyde, may be released to the environment through various waste streams through its production and use in perfumes and as flavoring agents. It is degraded in the atmosphere by reaction with photochemically produced hydroxyl radicals with an estimated half-life of about 20 hours. Tolualdehyde was listed in the 1980 VOCs database update with 2 reported occurrences; one measurement of urban air at a concentration of 0.132 ppbv and one source-dominated measurement giving a concentration of 0.006 ppbv (HSDB).

The mean concentration of tolualdehydes measured at the HAPS monitor in Loudon was 0.187 ppb from November 15, 2003 through December 23, 2004. This is not expected to present a health hazard.

Valeraldehyde

Valeraldehyde, also known as pentanal, is a natural product and is emitted into the atmosphere by plants and microorganisms and from animal wastes and forest fires. It may also be released to the environment during its production, use as a chemical intermediate, and during its transport, storage and disposal. Anthropogenic sources include emissions from gasoline, diesel, turbine engines, burning logs, and some building products, such as carpet-covered pressed board and polyurethane-coated plywood.

In the atmosphere, valeraldehyde will react with photochemically-produced hydroxyl radicals. It's half-life resulting from its reaction with hydroxyl radicals is 13.5 hr. Direct photolysis is also expected to be an important degradative process in the atmosphere. However, valeraldehyde's rate of direct photolysis is unknown. The general population may be exposed to valeraldehyde in both indoor and outdoor air via inhalation and by ingesting food in which it naturally occurs.

Valeraldehyde is a mild eye irritant.

The mean concentration of valeraldehyde measured at the HAPS monitor in Loudon was 0.267 ppb from November 15, 2003 through December 23, 2004. The level of valeraldehyde is not expected to present a health hazard.

Chloromethane

Chloromethane (also known as methyl chloride) is a clear, colorless gas. It has a faint, sweet odor that is noticeable only at levels which may be toxic. It is heavier than air and is extremely flammable. It also occurs naturally, and most of the chloromethane that is released to the environment (estimated at up to 99%) comes from natural sources. Chloromethane is always present in the air at very low levels. Most of the naturally occurring chloromethane comes from chemical reactions that occur in the oceans or from chemical reactions that occur when materials like grass, wood, charcoal, and coal are burned. It is also released to the air as a product of some plants or from rotting wood.

In addition to natural sources, chloromethane was manufactured as a refrigerant, but refrigerators no longer use chloromethane because of its toxic effects. It was also used as a foam-blowing agent and as a pesticide or fumigant. A working refrigerator that is more than 30 years old may still contain chloromethane, and may be a source of high-level exposure. Today, nearly all commercially produced chloromethane is used to make other substances, mainly silicones (72% of the total chloromethane used). Other products that are made from reactions involving chloromethane include agricultural chemicals (8%), methyl cellulose (6%), quaternary amines (5%), and butyl rubber (3%). These production processes yield very little or no residual choromethane emissions. It is, however, found as a pollutant in municipal waste streams from treatment plants and industrial waste streams as a result of formation or incomplete removal. There are also some manufacturing processes for vinyl chloride that produce small volumes of chloromethane as impurities in the vinyl chloride end product.

If the levels are high enough (over a million times the natural levels in outside air), even brief exposures to chloromethane can have serious effects on the nervous system, including convulsions, coma, and death. Some people have died from breathing chloromethane that leaked from refrigerators in rooms that had little or no ventilation. Most of these cases occurred more than 30 years ago, but this kind of exposure could still happen if you have an old refrigerator that contains chloromethane as the refrigerant. Exposure to chloromethane can also harm your liver and kidney, or have an effect on your heart rate and blood pressure. If you work in an industry that uses chloromethane to make other products, you might be exposed to levels that could cause symptoms resembling drunkenness and impaired ability to perform simple tasks (ATSDR 1998).

It is not known whether chloromethane can cause sterility, miscarriages, birth defects, or cancer in humans. The Department of Health and Human Services (DHHS) has not classified chloromethane for carcinogenic effects. The International Agency for Research on Cancer (IARC) calls chloromethane a Group 3 compound, which means it cannot be determined whether or not it is a carcinogen because there is not enough human or animal data. EPA considers chloromethane possibly carcinogenic to humans (i.e., Group C) based on limited evidence of carcinogenicity in animals.

ATSDR has derived an Environmental Media Evaluation Guide (EMEG) for chronic exposure to chloromethane of 50 ppb.

The mean concentration of chloromethane measured at the HAPS monitor in Loudon was 0.61 ppb from November 15, 2003 through December 23, 2004. No public health hazard is expected from exposure to these concentrations.

Ethylbenzene

Ethylbenzene is a colorless liquid that smells like gasoline. You can smell ethylbenzene in the air at concentrations as low as 2,000 parts of ethylbenzene per billion parts of air by volume (ppb). It evaporates at room temperature and burns easily. Ethylbenzene occurs naturally in coal tar and petroleum. It is also found in many products, including paints, inks, and insecticides. Gasoline contains about 2% (by weight) ethylbenzene. Ethylbenzene is used primarily in the production of styrene. It is also used as a solvent, a component of asphalt and naphtha, and in fuels. In the chemical industry, it is used in the manufacture of acetophenone, cellulose acetate, diethylbenzene, ethyl anthraquinone, ethylbenzene sulfonic acids, propylene oxide, and α-methylbenzyl alcohol. Consumer products containing ethylbenzene include pesticides, carpet glues, varnishes and paints, and tobacco products. In 1994, approximately 12 billion pounds of ethylbenzene were produced in the United States.

Ethylbenzene is most commonly found as a vapor in the air. This is because ethylbenzene moves easily into the air from water and soil. Once in the air, other chemicals help break down ethylbenzene into chemicals found in smog. This breakdown happens in less than 3 days with the aid of sunlight.

Releases of ethylbenzene into these areas occur from burning oil, gas, and coal and from discharges of ethylbenzene from some types of factories. The median level of ethylbenzene in city and suburban air is about 0.62 parts of ethylbenzene per billion parts (ppb) of air. In contrast, the median level of ethylbenzene measured in air in country locations is about 0.01 ppb. Indoor air has a higher median concentration of ethylbenzene (about 1 ppb) than outdoor air. This is because ethylbenzene builds up after you use household products such as cleaning products or paints.

At certain levels, exposure to ethylbenzene can harm your health. People exposed to high levels of ethylbenzene in the air for short periods have complained of eye and throat irritation. Persons exposed to higher levels have shown signs of more severe effects such as decreased movement and dizziness. No studies have reported death in humans following exposure to Ethylbenzene alone. However, evidence from animal studies suggests that it can cause death at very high concentrations in the air (about 2 million times the usual level in urban air).

Whether or not long-term exposure to ethylbenzene affects human health is not known because little information is available. Short-term exposure of laboratory animals to high concentrations of ethylbenzene in air may cause liver and kidney damage, nervous system changes, and blood changes. The link between these health effects and exposure to ethylbenzene is not clear because of conflicting results and weaknesses in many of the studies. Also, there is no clear evidence that the ability to get pregnant is affected by breathing air or drinking water containing ethylbenzene, or coming into direct contact with ethylbenzene through the skin. Two long-term studies in animals suggest that ethylbenzene may cause tumors. One study had many weaknesses, and no conclusions could be drawn about possible cancer effects in humans. The other, a recently completed study, was more convincing, and provided clear evidence that ethylbenzene causes cancer in one species after exposure in the air to concentrations greater than 740,000 ppb that were approximately 1 million times the levels found in urban air. At present, the federal government has not identified ethylbenzene as a chemical that may cause cancer in humans. However, this may change after consideration of the new data (ATSDR 1999b).

EPA's reference concentration for chronic exposure to ethylbenzene in air is 230 ppb and ATSDR's environmental media evaluation guide for an intermediate exposure is 1,000 ppb. The mean concentration of ethylbenzene measured at the HAPS monitor in Loudon was 0.11 ppb from November 15, 2003 through December 23, 2004. No public health hazard is expected from exposure to these concentrations.

Fully halogenated chlorofluorocarbons (CFCs)

Fully halogenated chlorofluorocarbons (CFCs) were scheduled for production phase-out in 1987 by the Montreal Protocol. Although originally scheduled for 50% production phase-out by the year 2000 in developed countries, the worsening ozone depletion has forced acceleration of the CFC phase-out (HSDB).

Dichlorodifluoromethane

Dichlordifluoromethane is a refrigerant (Freon 12), an aerosol propellant, and a foaming agent that has not been manufactured in the U.S. since 1995. This compound does not react with photochemically produced hydroxyl radicals, ozone molecules or nitrate radicals in the troposphere. This compound will gradually diffuse into the stratosphere above the ozone layer where it will slowly degrade due to direct photolysis from UV-C radiation and contribute to the catalytic removal of stratospheric ozone. Due to its long atmospheric residence time, the general population is exposed to dichlorodifluoromethane through inhalation of ambient air (HSDB).

The mean concentration of dichlorodifluoromethane measured at the HAPS monitor in Loudon was 0.58 ppb from November 15, 2003 through December 23, 2004.

Trichlorofluoromethane

Trichlorofluoromethane was used as a solvent, fire extinguisher, chemical intermediate, blowing agent. It was known as Freon 11. It's aerosol propellant use was banned in the US on December

15, 1978. Trichlorofluoromethane has been identified in emissions from volcanoes. Trichlorofluoromethane is very stable in the troposphere having a half-life of 52-207 yr. As a result of its stability, it is transported long distances and its concentration is fairly uniform around the globe away from known sources. The only major sink for trichlorofluoromethane is its slow diffusion into the stratosphere where photolysis occurs & subsequent reactions which destroy ozone (HSDB).

The mean concentration of trichlorofluoromethane measured at the HAPS monitor in Loudon was 0.34 ppb from November 15, 2003 through December 23, 2004.

Trichlorotrifluoroethane

Trichlorotrifluoroethane exists as two isomers: 1,1,1-trichloro-2,2,2-trifluoroethane, known as Freon FT, and 1,1,2-trichloro-1,2,2-trifluoroethane, known as chlorofluorocarbon (CFC). Freon FT was mostly used as a refrigereant, while CFC 113 was mostly used as a solvent, although it has refrigerant applications (HSDB).

The mean concentration of trichlorotrifluoromethane measured at the HAPS monitor in Loudon was 0.14 ppb from November 15, 2003 through December 23, 2004.

No public health hazard is expected from CFC's measured at the HAPs monitor in Loudon County.

Methyl Ethyl Ketone (2-Butanone)

Methyl ethyl ketone (MEK), also known as 2-butanone, is a colorless liquid with a sweet, but sharp odor. MEK is manufactured in large amounts for use in paints, glues, and other finishes because it rapidly evaporates and will dissolve many substances. It will quickly evaporate into the air. MEK is often found dissolved in water or as a gas in the air. MEK is also a natural product made by some trees and is found in some fruits and vegetables. The exhausts of cars and trucks release MEK into the air. MEK is usually found in the air, water, and soil of landfills and hazardous waste sites.

Serious health effects in animals have been seen only at very high concentrations of MEK. These high concentrations are not expected in the usual use of MEK or in the vicinity of hazardous waste sites. Studies in animals have shown that MEK does not cause serious damage to the nervous system or the liver, but mice that breathed low levels for a short time had temporary behavioral effects. MEK alone does not have serious effects on the liver or nervous system, but it can cause other chemicals to become more harmful to these systems (ATSDR 1992a).

ATSDR's reference concentration for exposure to MEK in air is 1,700 ppb. The mean concentration of MEK measured at the HAPS monitor in Loudon was 2.41 ppb from November 15, 2003 through December 23, 2004. No adverse health effects are expected from exposure to this level of MEK in air.

1,2,4-Trimethylbenzene

1,2,4-Trimethylbenzene is used as a sterilizing agent for catgut and as an intermediate in the manufacture of trimellitic anhydride, dyes, pharmaceuticals, and pseudocumidine. It's chief industrial use is as solvent and paint thinner. 1,2,4-trimethylbenzene is found in coal and gasoline and is a natural product in some foods (HSDB).

Concentrations of 1,2,4-trimethylbenzene have been found in ambient and indoor air in the U.S. and Europe ranging from not detected to 15 ppb (HSDB).

The mean concentration of 1,2,4-trimethylbenzene measured at the HAPS monitor in Loudon was 0.12 ppb from November 15, 2003 through December 23, 2004. No public health hazard is expected from exposure to this level of 1,2,4-trimethylbenzene.

Propylene

Propylene is used in the manufacture of polypropylene, alcohol, synthetic glycerol, acrylonitrile, propylene oxide, heptene, cumene, polymer gasoline, acrylic acid, vinyl resins, synthetic rubber, and as an aerosol propellant.

Some sources of propylene are biological in origin; it is a component of garlic essential oils, European fir, Scots pine, natural gases, and it is released by germinating beans, corn, cotton, and pea seeds. Propylene is released to the atmosphere in emissions from the combustion of gasoline, coal, wood and refuse. The most probable route of human exposure to propylene is by inhalation of contaminated air.

Propylene was detected at a concentration range of 7-32 ppbV in Los Angeles, California, air during Sept 29-Nov 13, 1981. Average monthly concentrations of propylene ranged from 1.1 to 15.3 ppbV in atmospheric samples taken at Deonar, India, in 1985. Concentrations in ambient air samples have been found to vary diurnally and with wind direction. Ground-level concentrations of propylene in urban air samples collected in several US cities ranged from 4 to 17 ppb (geometric mean), whereas concentrations in rural surface air samples from six domestic sites ranged from <0.5 to 3.0 ppb (geometric mean) (HSDB).

The mean concentration of propylene measured at the HAPS monitor in Loudon was 0.37 ppb from November 15, 2003 through December 23, 2004. No public health hazard is expected from exposure to these levels of propylene.

Styrene

In the United States, styrene is produced principally by the catalytic dehydrogenation of ethylbenzene. Styrene is used predominantly in the production of polystyrene plastics and resins. Some of these resins are used for construction purposes such as in insulation or in the fabrication of fiberglass boats. Styrene is also used as an intermediate.in the synthesis of materials used for ion exchange resins and to produce copolymers such as styrene-acrylonitrile (SAN), acrylonitrile-butadiene-styrene (ABS), and styrene-butadiene rubber (SBR). Consumer products made from styrene-containing compounds include packaging, electrical, and thermal insulation materials, pipes, automotive components, drinking tumblers, other food-use utensils, and carpet backing. The Food and Drug Administration (FDA) permits styrene to be used as a direct additive for synthetic flavoring and an indirect additive in polyester resins, ion-exchange membranes, and in rubber articles (5% by weight maximum) intended for use with foods.

Styrene has been detected among the natural volatile components of roasted filberts, dried legumes, fried chicken, nectarines, and Beaufort cheese. Styrene may also enter foods by migration from polystyrene food containers and packaging materials. Concentrations of styrene measured in yogurt packaged in polystyrene containers ranged from 5.5 to 150 µg /L. Mean levels of styrene in foods packaged in plastic in the United Kingdom ranged from <1 to 180 µg /kg. Similar concentrations of styrene were detected in other dairy products packaged in polystyrene containers.

The principal route of styrene exposure for the general population is probably by inhalation of contaminated indoor air. Mean indoor air levels of styrene have been reported in the range of l-9 µg/m3 (0.2-2 ppb), attributable to emissions from building materials, consumer products, and tobacco smoke. Occupational exposure to styrene by inhalation is the most likely means of significant exposure. The highest potential exposure is probably in the reinforced plastics industry and polystyrene factories. Exposure may also be high in areas near major spills.

The most commonly reported adverse health effects from exposure to styrene include subjective symptoms of central nervous system depression and irritation of the eyes and upper respiratory tract. Epidemiological and clinical studies on workers have demonstrated that inhalation exposure to styrene may cause alterations of central nervous system function. The symptoms are typical of central nervous system depression, and appear to be the most sensitive end point for styrene exposure via the inhalation route. High levels (800,000 ppb) produced immediate muscular weakness, listlessness, drowsiness, and impaired balance within minutes of exposure. Exposures to levels in the range of 50,000-200,000 ppb have resulted in a number of signs and symptoms, including impairment of balance and coordination, altered reaction times, sensory neuropathy, impaired manual dexterity, headaches, nausea, mood swings, malaise, and decrement in concentration. Some neurological effects, as evidenced by altered EEGs, occur at exposure levels as low as 25,000 to 31,000 ppb (ATSDR 1992).

ATSDR has established an EMEG of 60 ppb (60 ppb) for chronic, long-term exposure to styrene in air by the general population. EPA has established an RfC of 1000 µg/m^3 (235 ppb). EPA considers styrene to be a possible carcinogen based on the availability of no human data and limited animal data.

The average concentration of styrene measured at the HAPS monitor in Loudon was 0.19 ppb from November 15, 2003 through December 23, 2004. No public health hazard is expected from exposure to these levels of styrene.

Toluene

Toluene is a clear, colorless liquid with a distinctive smell. It is a good solvent (a substance that can dissolve other substances). It is added to gasoline along with benzene and xylene. Toluene occurs naturally in crude oil and in the tolu tree. It is produced in the process of making gasoline and other fuels from crude oil, in making coke from coal, and as a by-product in the manufacture of styrene. Toluene is used in making paints, paint thinners, fingernail polish, lacquers, adhesives, and rubber and in some printing and leather tanning processes. It is disposed of at hazardous waste sites as used solvent or at landfills where it is present in discarded paints, paint thinners, and fingernail polish. You can begin to smell toluene in the air at a concentration of 8,000 parts of toluene per billion parts of air (ppb), and taste it in your water at a concentration of between 40 and 1,000 ppb.

People may be exposed to toluene from many sources, including drinking water, food, air, and consumer products. They may also be exposed to toluene through breathing the chemical in the workplace or during deliberate glue sniffing or solvent abuse. Automobile exhaust also puts toluene into the air. People who work with gasoline, kerosene, heating oil, paints, and lacquers are at the greatest risk of exposure. Printers are also exposed to toluene in the workplace. Because toluene is a common solvent and is found in many consumer products, persons can be exposed to toluene at home and outdoors while using gasoline, nail polish, cosmetics, rubber cement, paints, paintbrush cleaners, stain removers, fabric dyes, inks, adhesives, carburetor cleaners, and lacquer thinners. Smokers are exposed to small amounts of toluene in cigarette smoke.

The toluene level in the air outside homes is usually less than 1,000 ppb in cities and suburbs that are not close to industry. The toluene inside houses is also likely to be less than 1,000 ppb. The amount of toluene in food has not been reported, but is likely to be low. Traces of toluene were found in eggs that were stored in polystyrene containers containing toluene.

People are probably exposed to only about 300 micrograms (µg) of toluene a day, unless they smoke cigarettes or work with toluene-containing products. People who smoke a pack of cigarettes per day, add another 1,000 µg to their exposure. People who work in places where toluene-containing products are used can be exposed to 1,000 milligrams of toluene a day when the average air concentration is 50,000 ppb and they breathe at a normal rate and volume (ATSDR 2000).

ATSDR's chronic EMEG for exposure to toluene in air is 80 ppb, while EPA's reference dose for chronic exposure is 107 ppb. The average concentration of toluene measured at the HAPS monitor in Loudon was 0.80 ppb from November 15, 2003 through December 23, 2004. No public health hazard is expected from exposure to these levels of toluene.

Xylenes

In this report, the terms xylene, xylenes, and total xylenes will be used interchangeably.
There are three forms of xylene in which the methyl groups vary on the benzene ring: metaxylene, ortho-xylene, and para-xylene (m-, o-, and p-xylene). These different forms are

referred to as isomers. The term total xylenes refers to all three isomers of xylene (m-, o-, and p-xylene). Mixed xylene is a mixture of the three isomers and usually also contains 6-15% ethylbenzene. Xylene is also known as xylol or dimethylbenzene. Xylene is primarily a synthetic chemical. Chemical industries produce xylene from petroleum. Xylene also occurs naturally in petroleum and coal tar and is formed during forest fires. It is a colorless, flammable liquid with a sweet odor.

Xylene is one of the top 30 chemicals produced in the United States in terms of volume. It is used as a solvent (a liquid that can dissolve other substances) in the printing, rubber, and leather industries. Along with other solvents, xylene is also used as a cleaning agent, a thinner for paint, and in varnishes. It is found in small amounts in airplane fuel and gasoline. Xylene is used as a material in the chemical, plastics, and synthetic fiber industries and as an ingredient in the coating of fabrics and papers. Isomers of xylene are used in the manufacture of certain polymers (chemical compounds), such as plastics.

Xylene evaporates and burns easily. Xylene does not mix well with water; however, it does mix with alcohol and many other chemicals. Most people begin to smell xylene in air at 80-3,700 parts of xylene per billion parts of air (ppb) and begin to taste it in water at 530-1,800 ppb. Xylene very quickly evaporates into the air from surface soil and water. Xylene stays in the air for several days until it is broken down by sunlight into other less harmful chemicals.

People may come in contact with xylene from a variety of consumer products, including cigarette smoke, gasoline, paint, varnish, shellac, and rust preventives. Breathing vapors from these types of products can expose persons to xylene. Indoor levels of xylene can be higher than outdoor levels, especially in buildings with poor ventilation. Skin contact with products containing xylene, such as solvents, lacquers, paint thinners and removers, and pesticides may also expose people to xylene.

Besides painters and paint industry workers, others who may be exposed to xylene include biomedical laboratory workers, distillers of xylene, wood processing plant workers, automobile garage workers, metal workers, and furniture refinishers also may be exposed to xylene. Workers who routinely come in contact with xylene-contaminated solvents in the workplace are the population most likely to be exposed to high levels of xylene.

The ATSDR chronic EMEG for total xylenes is 100,000 ppb. The average concentration of xylenes measured at the HAPS monitor in Loudon was 0.30 ppb for meta- and para-xylenes and 0.14 ppb for ortho-xylene from November 15, 2003 through December 23, 2004. No public health hazard is expected from exposure to these levels of xylenes.

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Appendix D

Diseases Included in Assessment of Hospital Discharge Death, and Cancer Incidence Data
Loudon County, Franklin County, and Tennessee.

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Diseases included in assessment of hospital discharge data, death data, and cancer incidence data for Loudon County, Franklin County, and Tennessee.

ICD-9CM & ICD-9 Codes	ICD-10 Codes	Disease Groups
147	C11	Nasopharynx Malignant Neoplasms
153	C18	Colon Malignant Neoplasms
154	C19-C20	Rectum Malignant Neoplasms
155	C22	Liver Malignant Neoplasms
160	C31	Sinus Malignant Neoplasms
161	C32	Larynx Malignant Neoplasms
162, except 162.0	C34	Bronchus and Lung Neoplasms
162.0	C33	Trachea Malignant Neoplasms
170	C40-C41	Bone Malignant Neoplasms
174-175	C50	Breast Malignant Neoplasms
179,182	C54-C55	Uterine Malignant Neoplasms
180, 181, 185	C51-C53, C57, C58	Other Female Reproductive Malignant Neoplasms
183	C56	Ovary Malignant Neoplasms
185	C61	Prostate Malignant Neoplasms
188	C67	Bladder Malignant Neoplasms
189	C64-C65	Kidney Malignant Neoplasms
191	C71	Brain Malignant Neoplasms
193	C73	Thyroid Malignant Neoplasms
204.0	C91.0	Leukemia, Acute Lymphoid
204.1-204.9	C91, C91.1-C91.9	Leukemia, Lymphoid
205.0	C92.0	Leukemia, Acute Myeloid
205.1-205.9	C92, C92.1-92.9	Leukemia, Myeloid
206.0	C93.0	Leukemia, Acute Monocytic
206.1-206.9	C93, C93.1-C93.9	Leukemia, Monocytic
207-208	C94-C95	Leukemia, all other and unspecified types
358.0	G70	Myasthenia Gravis
401,403	I10, I12	Hypertension, Primary
402,404	I11,I13	Hypertension, Secondary
410-414	I20-I25	Heart Diseases of Ischemic nature
415-429	I26-I51	Heart Disease of Other types
460-466	J01-J06, J20-J22	Acute Upper respiratory Infection (URI)
470-478	J30-J39	Chronic Rhinitis and Sinusitis (R&S)
480-482	J12-J18	Pneumonia
490-491	J40-J42	Chronic Bronchitis
492	J43	Emphysema
493	J45-J46	Asthma
494-496	J44, J47	Chronic Obstructive Pulmonary Disease (COPD)
500-506,508	J60-J68	Non-food (NF) Pneumoconioses
511	J90, J92, J94	Pleurisy
512,514-519	J70, J80-J84,J93, J96,J98	Other Diseases of the Respiratory System (DRS)

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Appendix E

Table of Disease Frequencies, Rates, p-values, Median Age, and Age Ranges for Loudon County Compared to Franklin County and Tennessee.

p-values are highlighted when they are statistically significant; green refers to rates that significantly lower in Loudon County, while yellow refers to rates that are significantly higher in Loudon County.

Rates expressed as per 100,000.

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Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
MALIGANT NEOPLASMS									
Bladder Malignancies									
Hospital Outpatients (1998-2003)									
Number	20	19	1840	54	41	4656	74	60	6496
Age Median (Range)	68 (20-86)	78 (36-85)	71 (5-99)	70 (56-94)	70 (48-84)	70 (10-106)	69 (20-94)	73 (36-85)	70 (5-106)
Crude Rate	16.51	15.65	10.46	47.03	35.67	27.92	31.36	25.39	18.96
Crude Rate, 95% CI	10.1-25.5	9.4-24.4	10-10.9	35.3-61.4	25.6-48.4	27.1-28.7	24.6-39.4	19.4-32.7	18.5-19.4
Crude Rate Ratio		1.05	1.58		1.32	1.68		1.24	1.65
Crude Rate Ratio, 95% CI		0.56-1.98	1.02-2.45		0.88-1.98	1.29-2.2		0.88-1.74	1.32-2.08
Rate, Mean for all Years	16.61	15.67	10.45	47.17	35.71	27.93	31.49	25.41	18.96
p-value for T-test, Loudon rate different		0.8818	0.1308		0.2180	0.0281		0.4089	0.0378
Hospital Inpatients (1997-2003)									
Number	13	23	1508	40	33	4182	53	56	5691
Age Median (Range)	73 (45-87)	75 (34-85)	75 (4-104)	70 (45-88)	79 (61-98)	73 (2-105)	72 (45-88)	78 (34-98)	74 (2-105)
Crude Rate	9.26	16.31	7.39	30.09	24.70	21.62	19.39	20.39	14.31
Crude Rate, 95% CI	4.9-15.8	10.3-24.5	7-7.8	21.5-41	17-34.7	21-22.3	14.5-25.4	15.4-26.5	13.9-14.7
Crude Rate Ratio		0.57	1.25		1.22	1.39		0.95	1.35
Crude Rate Ratio, 95% CI		0.29-1.12	0.73-2.16		0.77-1.93	1.02-1.9		0.65-1.38	1.03-1.78
Rate, Mean for all Years	9.21	16.34	7.38	30.29	24.63	21.61	19.45	20.37	14.31
p-value for T-test, Loudon rate different		0.1497	0.4510		0.5108	0.1876		0.8596	0.1416
TN Cancer Registry Incidence (1991-2000)									
Number	28	24	2280	63	42	6176	91	66	8456
Age Median (Range)	73 (45-91)	72 (34-94)	72 (6-103)	70 (47-93)	68.5 (30-89)	70 (-109)	72 (45-93)	70 (30-94)	70 (0-109)
Crude Rate	15.13	12.53	8.26	36.29	22.98	23.83	25.37	17.63	15.80
Crude Rate, 95% CI	10.1-21.9	8-18.6	7.9-8.6	27.9-46.4	16.6-31.1	23.2-24.4	20.4-31.2	13.6-22.4	15.5-16.1
Crude Rate Ratio		1.21	1.83		1.58	1.52		1.44	1.61
Crude Rate Ratio, 95% CI		0.7-2.08	1.26-2.66		1.07-2.33	1.19-1.95		1.05-1.98	1.31-1.97
Rate, Mean for all Years	15.21	12.41	8.25	35.99	22.82	23.83	25.28	17.49	15.79
p-value for T-test, Loudon rate different		0.3976	0.0137		0.1546	0.1443		0.1193	0.0256
Deaths (1990-2003)									
Number	9	13	1037	14	14	2007	23	27	3044
Age Median (Range)	76 (45-84)	80 (57-95)	79 (7-103)	77.5 (58-99)	73 (64-90)	75 (29-102)	76 (45-99)	75 (57-95)	77 (7-103)
Crude Rate	3.42	4.80	2.66	5.66	4.80	5.46	4.51	5.11	4.02

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Crude Rate, 95% CI	1.6-6.5	2.6-8.2	2.5-2.8	3.1-9.5	3-9.1	5.2-5.7	2.9-6.8	3.4-7.4	3.9-4.2
Crude Rate Ratio		0.71	1.29		1.04	1.04		0.88	1.12
Crude Rate Ratio, 95% CI		0.3-1.67	0.67-2.48		0.5-2.19	0.61-1.75		0.51-1.54	0.74-1.69
Rate, Mean for all Years	3.37	4.79	2.65	5.69	5.36	5.46	4.49	5.06	4.01
p-value for T-test, Loudon rate different		0.4553	0.5441		0.8184	0.8337		0.5983	0.5240
Bone Malignancies									
Hospital Outpatients (1998-2003)									
Number	3	2	333	3	5	324	6	7	657
Age Median (Range)	15 (*)	68 (*)	53 (1-99)	43 (*)	40 (13-68)	51 (2-92)	29 (11-63)	41 (13-71)	52 (1-99)
Crude Rate	2.48	1.65	1.89	2.61	4.35	1.94	2.54	2.96	1.92
Crude Rate, 95% CI	0.5-7.2	0.2-6	1.7-2.1	0.5-7.6	1.4-10.2	1.7-2.2	0.9-5.5	1.2-6.1	1.8-2.1
Crude Rate Ratio		1.50	1.31		0.60	1.34		0.86	1.33
Crude Rate Ratio, 95% CI		0.25-9	0.42-4.08		0.14-2.51	0.43-4.19		0.29-2.55	0.59-2.96
Rate, Mean for all Years	2.41	1.66	1.89	2.56	4.38	1.94	2.49	2.98	1.92
p-value for T-test, Loudon rate different		0.7056	0.7623		0.5629	0.8195		0.8193	0.7511
Hospital Inpatients (1997-2003)									
Number	4	1	438	5	7	470	9	8	908
Age Median (Range)	68 (15-83)	*	50 (3-94)	43 (42-46)	55 (13-73)	49 (0-98)	44 (15-83)	56 (13-73)	49 (0-98)
Crude Rate	2.85	0.71	2.15	3.76	5.24	2.43	3.29	2.91	2.28
Crude Rate, 95% CI	0.8-7.3	0-4	1.9-2.3	1.2-8.8	2.1-10.8	2.2-2.6	1.5-6.2	1.2-5.7	2.1-2.4
Crude Rate Ratio		4.02	1.33		0.72	1.55		1.13	1.44
Crude Rate Ratio, 95% CI		0.45-35.94	0.5-3.55		0.23-2.26	0.64-3.74		0.44-2.93	0.75-2.78
Rate, Mean for all Years	2.89	0.70	2.15	3.67	5.27	2.43	3.28	2.92	2.29
p-value for T-test, Loudon rate different		0.2158	0.6440		0.4774	0.4284		0.8025	0.3241
TN Cancer Registry Incidence (1991-2000)									
Number	*	*	293	*	*	311	6	*	604
Age Median (Range)	*	*	62 (0-94)	*	*	51 (3-94)	72.5 (31-81)	*	57 (0-94)
Crude Rate	*	*	1.06	*	*	1.20	1.67	*	1.13
Crude Rate, 95% CI	*	*	0.9-1.2	*	*	1.1-1.3	0.6-3.6	*	1-1.2
Crude Rate Ratio		*	*		*	*		*	1.48
Crude Rate Ratio, 95% CI		*	*		*	*		*	0.66-3.31
Rate, Mean for all Years	*	*	*	*	*	1.20	1.67	*	1.13
p-value for T-test, Loudon rate different		*	*		*	*		*	0.5440

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Deaths (1990-2003)									
Number	2	1	134	4	2	177	6	3	311
Age Median (Range)	13 (*)	*	68.5 (8-97)	68 (44-86)	45.5 (*)	56 (7-91)	56 (11-86)	62 (*)	62 (7-97)
Crude Rate	0.76	0.37	0.34	1.62	0.37	0.48	1.18	0.57	0.41
Crude Rate, 95% CI	0.1-2.7	0-2.1	0.3-0.4	0.4-4.1	0.1-2.8	0.4-0.6	0.4-2.6	0.1-1.7	0.4-0.5
Crude Rate Ratio		2.06	2.22		2.09	3.36		2.07	2.87
Crude Rate Ratio, 95% CI		0.19-22.72	0.55-8.96		0.38-11.39	1.25-9.04		0.52-8.29	1.28-6.43
Rate, Mean for all Years	0.69	0.36	0.34	1.52	0.75	0.48	1.10	0.55	0.41
p-value for T-test, Loudon rate different		0.5747	0.4710		0.5043	0.2515		0.4053	0.2044
Brain Malignancies									
Hospital Outpatients (1998-2003)									
Number	2	2	606	7	8	644	9	10	1250
Age Median (Range)	51 (*)	57 (*)	40 (0-94)	12 (0-51)	8.5 (4-87)	39 (0-89)	39 (0-54)	31 (4-87)	39 (0-94)
Crude Rate	1.65	1.65	3.45	6.10	6.96	3.86	3.81	4.23	3.65
Crude Rate, 95% CI	0.2-6	0.2-6	3.2-3.7	2.5-12.6	2.9-13.7	3.6-4.2	1.7-7.2	2-7.8	3.4-3.9
Crude Rate Ratio		1.00	0.48		0.88	1.58		0.90	1.05
Crude Rate Ratio, 95% CI		0.14-7.11	0.12-1.92		0.32-2.42	0.75-3.32		0.37-2.22	0.54-2.01
Rate, Mean for all Years	1.63	1.64	3.43	5.96	6.95	3.85	3.74	4.22	3.64
p-value for T-test, Loudon rate different		0.9957	0.3325		0.8331	0.6465		0.8799	0.9735
Hospital Inpatients (1997-2003)									
Number	16	8	1756	29	16	2161	45	24	3917
Age Median (Range)	66 (27-92)	56 (36-80)	56 (0-98)	58 (1-82)	31 (1-83)	52 (0-98)	58 (1-92)	44 (1-83)	54 (0-98)
Crude Rate	11.39	5.67	8.60	21.81	11.98	11.17	16.46	8.74	9.85
Crude Rate, 95% CI	6.5-18.5	2.4-11.2	8.2-9	14.6-31.3	6.8-19.5	10.7-11.6	12-22	5.6-13	9.5-10.2
Crude Rate Ratio		2.01	1.32		1.82	1.95		1.88	1.67
Crude Rate Ratio, 95% CI		0.86-4.69	0.81-2.17		0.99-3.35	1.35-2.82		1.15-3.09	1.25-2.24
Rate, Mean for all Years	11.46	5.74	8.60	21.84	12.01	11.17	16.51	8.79	9.85
p-value for T-test, Loudon rate different		0.1352	0.3340		0.0208	0.0045		0.0040	0.0053
TN Cancer Registry Incidence (1991-2000)									
Number	16	13	1540	18	13	1822	34	26	3362
Age Median (Range)	63 (22-80)	54 (12-74)	59 (0-92)	59 (25-84)	63 (0-81)	54 (0-91)	59.5 (22-84)	58.5 (0-81)	57 (0-92)
Crude Rate	8.65	6.79	5.58	10.37	7.11	7.03	9.48	6.95	6.28
Crude Rate, 95% CI	4.9-14	3.6-11.6	5.3-5.9	6.1-16.4	3.8-12.2	6.7-7.4	6.6-13.2	4.5-10.2	6.1-6.5

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Crude Rate Ratio		1.27	1.55		1.46	1.47		1.36	1.51
Crude Rate Ratio, 95% CI		0.61-2.65	0.95-2.54		0.71-2.97	0.93-2.35		0.82-2.27	1.08-2.12
Rate, Mean for all Years	8.75	6.89	5.58	10.32	7.11	7.04	9.51	7.00	6.29
p-value for T-test, Loudon rate different		0.5575	0.2455		0.3934	0.2146		0.3481	0.0911
Deaths (1990-2003)									
Number	15	20	1904	25	23	2237	40	43	4141
Age Median (Range)	78 (27-92)	59.5 (22-82)	66 (0-99)	61 (31-101)	71 (10-86)	61 (0-101)	71 (27-101)	67 (10-86)	63 (0-101)
Crude Rate	5.71	7.39	4.88	10.11	7.39	6.09	7.84	8.13	5.46
Crude Rate, 95% CI	3.2-9.4	4.5-11.4	4.7-5.1	6.5-14.9	5.7-13.4	5.8-6.3	5.6-10.7	5.9-11	5.3-5.6
Crude Rate Ratio		0.77	1.17		1.13	1.66		0.96	1.44
Crude Rate Ratio, 95% CI		0.4-1.51	0.7-1.95		0.64-2	1.12-2.46		0.63-1.48	1.05-1.96
Rate, Mean for all Years	5.78	7.51	4.88	10.23	8.98	6.10	7.93	8.22	5.47
p-value for T-test, Loudon rate different		0.5442	0.6256		0.6686	0.0411		0.8975	0.0522
Breast Malignancies									
Hospital Outpatients (1998-2003)									
Number	173	148	20575	0	2	96	173	150	20674
Age Median (Range)	62 (35-95)	63 (33-92)	58 (0-104)		62 (*)	64 (28-87)	62 (35-95)	63 (33-92)	58 (0-104)
Crude Rate	142.82	121.92	117.01	0.00	1.74	0.58	73.32	63.47	60.34
Crude Rate, 95% CI	121.5-164.1	102.3-141.6	115.4-118.6	NA	0.2-6.3	0.5-0.7	62.4-84.2	53.3-73.6	59.5-61.2
Crude Rate Ratio		1.17	1.22		NA	NA		1.16	1.22
Crude Rate Ratio, 95% CI		0.94-1.46	1.05-1.42		NA	NA		0.93-1.44	1.05-1.41
Rate, Mean for all Years	142.45	121.90	116.74	0.00	1.74	0.58	73.11	63.45	60.19
p-value for T-test, Loudon rate different		0.1943	0.1115		0.1449	0.0005		0.2457	0.1155
Hospital Inpatients (1997-2003)									
Number	153	167	19163	1	0	125	154	167	19295
Age Median (Range)	64 (34-95)	70 (36-96)	64 (21-106)	*	NA	67 (36-94)	64 (34-95)	70 (36-96)	64 (21-106)
Crude Rate	108.95	118.42	93.85	0.75	0.00	0.65	56.33	60.82	48.53
Crude Rate, 95% CI	91.7-126.2	100.5-136.4	92.5-95.2	0-4.2	NA	0.5-0.8	47.4-65.2	51.6-70	47.8-49.2
Crude Rate Ratio		0.92	1.16		NA	1.16		0.93	1.16
Crude Rate Ratio, 95% CI		0.74-1.15	0.99-1.36		NA	0.16-8.33		0.74-1.15	0.99-1.36
Rate, Mean for all Years	109.11	118.54	93.93	0.78	0.00	0.65	56.44	60.87	48.58
p-value for T-test, Loudon rate different		0.1841	0.0278		0.3559	0.8755		0.2364	0.0339
TN Cancer Registry Incidence (1991-2000)									

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Number	287	208	32739	*	*	288	290	210	33028
Age Median (Range)	62 (30-95)	65 (34-90)	62 (13-106)	*	*	66 (26-96)	62 (30-95)	65 (30-90)	62 (13-106)
Crude Rate	155.09	108.60	118.58	*	*	1.11	80.85	56.11	61.70
Crude Rate, 95% CI	137.1-173	93.8-123.4	117.3-119.9	*	*	1-1.2	71.5-90.2	48.5-63.7	61-62.4
Crude Rate Ratio		1.43	1.31		*	1.56		1.44	1.31
Crude Rate Ratio, 95% CI		1.19-1.71	1.16-1.47		*	0.5-4.85		1.21-1.72	1.17-1.47
Rate, Mean for all Years	154.26	107.56	118.31	*	*	1.10	80.42	55.61	61.56
p-value for T-test, Loudon rate different		0.0025	0.0014		*	0.5027		0.0022	0.0012
Deaths (1990-2003)									
Number	81	74	12186	1	1	85	82	75	12271
Age Median (Range)	67 (33-96)	66 (40-94)	66 (0-108)	*	*	71 (32-94)	67 (33-96)	66 (40-94)	67 (0-108)
Crude Rate	30.82	27.34	31.21	0.40	27.34	0.23	16.07	14.19	16.19
Crude Rate, 95% CI	24.5-38.3	21.5-34.3	30.7-31.8	0-2.3	0-2.2	0.2-0.3	12.8-20	11.2-17.8	15.9-16.5
Crude Rate Ratio		1.13	0.99		1.04	1.75		1.13	0.99
Crude Rate Ratio, 95% CI		0.82-1.54	0.79-1.23		0.07-16.68	0.24-12.55		0.83-1.55	0.8-1.23
Rate, Mean for all Years	31.03	27.44	31.29	0.43	0.39	0.23	16.20	14.24	16.24
p-value for T-test, Loudon rate different		0.3756	0.9369		0.9469	0.6523		0.3589	0.9814
Bronchus and Lung Malignancies									
Hospital Outpatients (1998-2003)									
Number	69	74	6921	90	95	8890	159	169	15811
Age Median (Range)	67 (42-90)	68 (47-105)	66 (1-105)	68 (37-83)	67 (41-87)	66 (0-98)	68 (37-90)	68 (41-105)	66 (0-105)
Crude Rate	56.96	60.96	39.36	78.38	82.66	53.30	67.39	71.51	46.15
Crude Rate, 95% CI	44.3-72.1	47.9-76.5	38.4-40.3	63-96.3	66.9-101	52.2-54.4	56.9-77.9	60.7-82.3	45.4-46.9
Crude Rate Ratio		0.93	1.45		0.95	1.47		0.94	1.46
Crude Rate Ratio, 95% CI		0.67-1.3	1.14-1.83		0.71-1.26	1.19-1.81		0.76-1.17	1.25-1.71
Rate, Mean for all Years	56.91	60.65	39.23	78.58	82.64	53.30	67.44	71.35	46.10
p-value for T-test, Loudon rate different		0.8123	0.1270		0.7706	0.0524		0.7339	0.0333
Hospital Inpatients (1997-2003)									
Number	129	90	12936	201	154	19445	330	244	32385
Age Median (Range)	67 (28-93)	68 (43-89)	68 (0-102)	68 (29-89)	70 (41-87)	68 (1-102)	68 (28-93)	69 (41-89)	68 (0-102)
Crude Rate	91.86	63.82	63.36	151.19	115.29	100.53	120.71	88.86	81.45
Crude Rate, 95% CI	76-107.7	51.3-78.4	62.3-64.4	130.3-172.1	97.1-133.5	99.1-101.9	107.7-133.7	77.7-100	80.6-82.3
Crude Rate Ratio		1.44	1.45		1.31	1.50		1.36	1.48

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Crude Rate Ratio, 95% CI		1.1-1.88	1.22-1.72		1.06-1.62	1.31-1.73		1.15-1.6	1.33-1.65
Rate, Mean for all Years	92.03	63.68	63.32	151.38	115.19	100.57	120.91	88.74	81.45
p-value for T-test, Loudon rate different		0.0351	0.0349		0.0086	0.0002		0.0034	0.0008
TN Cancer Registry Incidence (1991-2000)									
Number	131	72	14285	221	162	24275	352	234	38561
Age Median (Range)	65 (33-90)	65 (34-90)	67 (4-100)	67 (38-94)	68 (41-87)	67 (15-100)	66 (33-94)	68 (33-88)	67 (4-100)
Crude Rate	70.79	37.59	51.74	127.30	88.66	93.66	98.14	62.52	72.04
Crude Rate, 95% CI	62.1-87	29.4-47.3	50.9-52.6	120.2-155.1	75-102.3	92.5-94.8	94.5-115.7	54.5-70.5	71.3-72.8
Crude Rate Ratio		1.88	1.37		1.44	1.36		1.57	1.36
Crude Rate Ratio, 95% CI		1.49-2.64	1.22-1.7		1.27-1.9	1.29-1.67		1.43-1.98	1.32-1.61
Rate, Mean for all Years	70.63	37.20	51.61	128.33	87.76	93.75	98.54	61.86	72.01
p-value for T-test, Loudon rate different		0.0009	0.0274		0.0245	0.0056		0.0009	0.0006
Deaths (1990-2003)									
Number	147	132	17992	289	268	34231	436	400	52223
Age Median (Range)	69 (39-92)	70 (33-98)	69 (10-105)	69 (38-92)	70.5 (41-90)	69 (0-102)	69 (38-92)	70 (33-98)	69 (0-105)
Crude Rate	55.93	48.76	46.08	116.86	48.76	93.17	85.47	75.66	68.91
Crude Rate, 95% CI	46.9-65	40.4-57.1	45.4-46.8	103.4-130.3	91.4-116.3	92.2-94.2	77.4-93.5	68.2-83.1	68.3-69.5
Crude Rate Ratio		1.15	1.21		1.12	1.25		1.13	1.24
Crude Rate Ratio, 95% CI		0.91-1.45	1.03-1.43		0.95-1.33	1.12-1.41		0.99-1.29	1.13-1.36
Rate, Mean for all Years	54.89	48.29	45.86	117.06	103.75	93.40	85.00	75.37	68.89
p-value for T-test, Loudon rate different		0.3677	0.1505		0.1314	0.0025		0.0724	0.0011
Colon Malignancies									
Hospital Outpatients (1998-2003)									
Number	26	20	3146	18	29	2748	44	49	5894
Age Median (Range)	70 (31-89)	69 (35-87)	66 (18-111)	70 (45-84)	64 (39-92)	65 (9-99)	70 (31-89)	68 (35-92)	66 (9-111)
Crude Rate	21.46	16.48	17.89	15.68	25.23	16.48	18.65	20.73	17.20
Crude Rate, 95% CI	14-31.4	10.1-25.4	17.3-18.5	9.3-24.8	16.9-36.2	15.9-17.1	13.5-25	15.3-27.4	16.8-17.6
Crude Rate Ratio		1.30	1.20		0.62	0.95		0.90	1.08
Crude Rate Ratio, 95% CI		0.73-2.33	0.82-1.76		0.35-1.12	0.6-1.51		0.6-1.35	0.81-1.46
Rate, Mean for all Years	21.40	16.50	17.84	15.54	25.33	16.46	18.56	20.79	18.56
p-value for T-test, Loudon rate different		0.4732	0.5650		0.2242	0.8391		0.6844	0.7256
Hospital Inpatients (1997-2003)									
Number	85	55	9097	79	69	8310	164	124	17411

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Age Median (Range)	76 (31-93)	72 (32-98)	72 (17-104)	71 (40-92)	70 (32-90)	69 (9-101)	73 (31-93)	71 (32-98)	71 (9-104)
Crude Rate	60.53	39.00	44.55	59.42	51.66	42.96	59.99	45.16	43.79
Crude Rate, 95% CI	48.3-74.8	29.4-50.8	43.6-45.5	47-74.1	40.2-65.4	42-43.9	50.8-69.2	37.2-53.1	43.1-44.4
Crude Rate Ratio		1.55	1.36		1.15	1.38		1.33	1.37
Crude Rate Ratio, 95% CI		1.11-2.18	1.1-1.68		0.83-1.59	1.11-1.73		1.05-1.68	1.17-1.6
Rate, Mean for all Years	60.52	39.20	44.56	59.87	51.67	42.96	60.19	45.26	43.79
p-value for T-test, Loudon rate different		0.0167	0.0190		0.4680	0.1450		0.0684	0.0474
TN Cancer Registry Incidence (1991-2000)									
Number	87	66	9907	88	67	8922	175	133	18829
Age Median (Range)	71 (31-93)	73 (27-90)	72 (9-104)	69 (40-91)	69 (29-90)	69 (7-101)	70 (31-93)	70 (27-90)	71 (7-104)
Crude Rate	47.01	34.46	35.88	50.69	36.67	34.42	48.79	35.54	35.18
Crude Rate, 95% CI	37.7-58	26.7-43.8	35.2-36.6	40.7-62.4	28.4-46.6	33.7-35.1	41.6-56	29.5-41.6	34.7-35.7
Crude Rate Ratio		1.36	1.31		1.38	1.47		1.37	1.39
Crude Rate Ratio, 95% CI		0.99-1.88	1.06-1.62		1.01-1.9	1.19-1.82		1.1-1.72	1.2-1.61
Rate, Mean for all Years	46.71	34.52	35.88	50.29	36.35	34.40	48.44	35.40	35.17
p-value for T-test, Loudon rate different		0.0488	0.0636		0.0642	0.0106		0.0088	0.0042
Deaths (1990-2003)									
Number	50	56	7166	52	50	6798	102	106	13964
Age Median (Range)	77 (48-92)	75 (33-98)	76 (21-105)	74 (38-88)	71.5 (29-92)	72 (10-101)	75.5 (38-92)	72.5 (29-98)	74 (10-105)
Crude Rate	19.02	20.69	18.35	21.03	20.69	18.50	20.00	20.05	18.43
Crude Rate, 95% CI	14.1-25.1	15.6-26.9	17.9-18.8	15.7-27.6	14.4-25.6	18.1-18.9	16.1-23.9	16.2-23.9	18.1-18.7
Crude Rate Ratio		0.92	1.04		1.08	1.14		1.00	1.09
Crude Rate Ratio, 95% CI		0.63-1.35	0.78-1.37		0.74-1.6	0.87-1.49		0.76-1.31	0.89-1.32
Rate, Mean for all Years	19.31	20.74	18.40	21.05	19.32	18.54	20.15	20.05	18.47
p-value for T-test, Loudon rate different		0.6395	0.5854		0.5664	0.1965		0.9578	0.1452
Kidney Malignancies									
Hospital Outpatients (1998-2003)									
Number	3	5	561	15	10	785	18	15	1346
Age Median (Range)	67 (*)	69 (61-80)	65 (0-97)	56 (2-81)	63 (17-75)	64 (0-94)	60 (2-81)	68 (17-80)	64 (0-97)
Crude Rate	2.48	4.12	3.19	13.06	8.70	4.71	7.63	6.35	3.93
Crude Rate, 95% CI	0.5-7.2	1.3-9.6	2.9-3.5	7.3-21.5	4.2-16	4.4-5	4.5-12.1	3.6-10.5	3.7-4.1
Crude Rate Ratio		0.60	0.78		1.50	2.78		1.20	1.94
Crude Rate Ratio, 95% CI		0.14-2.52	0.25-2.41		0.67-3.34	1.67-4.63		0.61-2.38	1.22-3.09

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Rate, Mean for all Years	2.44	4.08	3.18	13.17	8.69	4.71	7.65	6.32	3.92
p-value for T-test, Loudon rate different		0.5783	0.6793		0.4223	0.0534		0.6580	0.0247
Hospital Inpatients (1997-2003)									
Number	20	8	2501	44	35	3562	64	43	6064
Age Median (Range)	70 (1-97)	67 (54-78)	67 (0-100)	63 (2-96)	63 (4-88)	64 (0-101)	64 (1-97)	65 (4-88)	65 (0-101)
Crude Rate	14.24	5.67	12.25	33.10	26.20	18.42	23.41	15.66	15.25
Crude Rate, 95% CI	8.7-22	2.4-11.2	11.8-12.7	24-44.4	18.3-36.4	17.8-19	18-29.9	11.3-21.1	14.9-15.6
Crude Rate Ratio		2.51	1.16		1.26	1.80		1.50	1.53
Crude Rate Ratio, 95% CI		1.11-5.7	0.75-1.81		0.81-1.97	1.34-2.42		1.02-2.2	1.2-1.96
Rate, Mean for all Years	14.17	5.65	12.23	33.11	26.21	18.38	23.38	15.65	15.22
p-value for T-test, Loudon rate different		0.0383	0.4637		0.3417	0.0370		0.0442	0.0170
TN Cancer Registry Incidence (1991-2000)									
Number	16	16	2139	41	25	3208	57	41	5347
Age Median (Range)	61.5 (2-84)	69 (32-84)	66 (0-97)	63 (2-85)	54 (4-82)	63 (0-99)	62 (2-85)	60 (4-84)	64 (0-99)
Crude Rate	8.65	8.35	7.75	23.62	13.68	12.38	15.89	10.95	9.99
Crude Rate, 95% CI	4.9-14	4.8-13.6	7.4-8.1	16.9-32	8.9-20.2	11.9-12.8	12-20.6	7.9-14.9	9.7-10.3
Crude Rate Ratio		1.04	1.12		1.73	1.91		1.45	1.59
Crude Rate Ratio, 95% CI		0.52-2.07	0.68-1.82		1.05-2.84	1.4-2.6		0.97-2.17	1.23-2.07
Rate, Mean for all Years	8.47	8.28	7.71	23.77	13.57	12.35	15.87	10.86	9.96
p-value for T-test, Loudon rate different		0.9556	0.7691		0.0548	0.0267		0.0877	0.0122
Deaths (1990-2003)									
Number	9	2	1296	20	21	2159	29	23	3455
Age Median (Range)	74 (60-97)	58.5 (*)	72 (1-100)	63 (46-85)	69 (46-85)	68 (3-101)	67 (46-97)	69 (46-85)	69 (1-101)
Crude Rate	3.42	0.74	3.32	8.09	0.74	5.88	5.68	4.35	4.56
Crude Rate, 95% CI	1.6-6.5	0.1-2.7	3.1-3.5	4.9-12.5	5-12.4	5.6-6.1	3.8-8.2	2.8-6.5	4.4-4.7
Crude Rate Ratio		4.63	1.03		0.99	1.38		1.31	1.25
Crude Rate Ratio, 95% CI		1-21.45	0.54-1.99		0.54-1.83	0.89-2.14		0.76-2.26	0.87-1.8
Rate, Mean for all Years	3.50	0.76	3.32	8.15	8.20	5.89	5.75	4.39	4.56
p-value for T-test, Loudon rate different		0.0355	0.8744		0.9845	0.2554		0.3745	0.3334
Larynx Malignancies									
Hospital Outpatients (1998-2003)									
Number	0	2	380	10	5	1197	10	7	1577
Age Median (Range)	NA	63 (*)	61 (15-92)	62 (51-68)	62 (8-81)	62 (8-94)	62 (51-68)	62 (8-81)	62 (8-94)

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Crude Rate	0.00	1.65	2.16	8.71	4.35	7.18	4.24	2.96	4.60
Crude Rate, 95% CI	NA	0.2-6	1.9-2.4	4.2-16	1.4-10.2	6.8-7.6	2-7.8	1.2-6.1	4.4-4.8
Crude Rate Ratio		NA	NA		2.00	1.21		1.43	0.92
Crude Rate Ratio, 95% CI		NA	NA		0.68-5.86	0.65-2.26		0.54-3.76	0.49-1.71
Rate, Mean for all Years	0.00	1.66	2.15	8.75	4.33	7.18	4.26	2.96	4.60
p-value for T-test, Loudon rate different		0.1449	0.0003		0.1753	0.5205		0.4409	0.7695
Hospital Inpatients (1997-2003)									
Number	0	1	457	12	9	1457	12	10	1914
Age Median (Range)	NA	*	62 (17-100)	52 (39-84)	55 (10-81)	63 (10-93)	52 (39-84)	55 (10-81)	63 (10-100)
Crude Rate	0.00	0.71	2.24	9.03	6.74	7.53	4.39	3.64	4.81
Crude Rate, 95% CI	NA	0-4	2-2.4	4.7-15.8	3.1-12.8	7.1-7.9	2.3-7.7	1.7-6.7	4.6-5
Crude Rate Ratio		NA	NA		1.34	1.20		1.21	0.91
Crude Rate Ratio, 95% CI		NA	NA		0.56-3.18	0.68-2.11		0.52-2.79	0.52-1.61
Rate, Mean for all Years	0.00	0.70	2.24	9.01	6.73	7.54	4.38	3.64	4.82
p-value for T-test, Loudon rate different		NA	<.0001		0.3003	0.3598		0.4864	0.5738
TN Cancer Registry Incidence (1991-2000)									
Number	*	*	627	19	11	2240	24	15	2867
Age Median (Range)	*	*	63 (15-95)	61 (47-83)	67 (52-84)	63 (20-96)	60.5 (47-83)	66 (43-84)	63 (15-96)
Crude Rate	*	*	2.27	10.94	6.02	8.64	6.69	4.01	5.36
Crude Rate, 95% CI	*	*	2.1-2.4	6.6-17.1	3-10.8	8.3-9	4.3-10	2.2-6.6	5.2-5.6
Crude Rate Ratio		*	*		1.82	1.27		1.67	1.25
Crude Rate Ratio, 95% CI		*	*		0.87-3.82	0.81-1.99		0.88-3.18	0.84-1.87
Rate, Mean for all Years	*	*	2.28	11.04	6.09	8.66	6.81	4.06	5.37
p-value for T-test, Loudon rate different		*	*		0.1240	0.3454		0.1655	0.4090
Deaths (1990-2003)									
Number	1	2	250	6	9	1001	7	11	1251
Age Median (Range)	*	66 (*)	68 (19-95)	74.5 (50-88)	72 (55-83)	66 (32-96)	74 (50-88)	72 (55-83)	66 (19-96)
Crude Rate	0.38	0.74	0.64	2.43	0.74	2.72	1.37	2.08	1.65
Crude Rate, 95% CI	0-2.1	0.1-2.7	0.6-0.7	0.9-5.3	1.6-6.6	2.6-2.9	0.6-2.8	1-3.7	1.6-1.7
Crude Rate Ratio		0.51	0.59		0.70	0.89		0.66	0.83
Crude Rate Ratio, 95% CI		0.05-5.68	0.08-4.24		0.25-1.95	0.4-1.99		0.26-1.7	0.4-1.75
Rate, Mean for all Years	0.41	0.74	0.64	2.42	3.48	2.73	1.39	2.08	1.65
p-value for T-test, Loudon rate different		0.6167	0.5935		0.5813	0.7564		0.5120	0.6519

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Leukemia, Acute Lymphoid									
Hospital Outpatients (1998-2003)									
Number	0	0	420	1	1	470	1	1	890
Age Median (Range)	NA	NA	11 (0-85)	*	*	9 (0-84)	*	*	10 (0-85)
Crude Rate	0.00	0.00	2.39	0.87	0.87	2.82	0.42	0.42	2.60
Crude Rate, 95% CI	NA	NA	2.2-2.6	0-4.9	0-4.8	2.6-3.1	0-2.4	0-2.4	2.4-2.8
Crude Rate Ratio		NA	NA		1.00	0.31		1.00	0.16
Crude Rate Ratio, 95% CI		NA	NA		0.06-16	0.04-2.2		0.06-16.01	0.02-1.16
Rate, Mean for all Years	0.00	0.00	2.38	0.90	0.86	2.81	0.44	0.42	2.59
p-value for T-test, Loudon rate different		NA	0.0022		0.9735	0.0918		0.9758	0.0055
Hospital Inpatients (1997-2003)									
Number	1	0	418	2	2	521	3	2	941
Age Median (Range)	*	NA	16 (0-96)	3.5 (*)	3.5 (*)	18 (0-93)	4 (*)	3.5 (*)	18 (0-96)
Crude Rate	0.71	0.00	2.05	1.50	1.50	2.69	1.10	0.73	2.37
Crude Rate, 95% CI	0-4	NA	1.9-2.2	0.2-5.4	0.2-5.4	2.5-2.9	0.2-3.2	0.1-2.6	2.2-2.5
Crude Rate Ratio		NA	0.35		1.00	0.56		1.51	0.46
Crude Rate Ratio, 95% CI		NA	0.05-2.47		0.14-7.13	0.14-2.24		0.25-9.02	0.15-1.44
Rate, Mean for all Years	0.70	0.00	2.05	1.56	1.48	2.70	1.11	0.72	2.37
p-value for T-test, Loudon rate different		0.3559	0.1014		0.9541	0.3060		0.5854	0.0545
TN Cancer Registry Incidence (1991-2000)									
Number	*	*	280	*	*	360	*	*	640
Age Median (Range)	*	*	16.5 (0-93)	*	*	14 (0-92)	*	*	14.5 (0-93)
Crude Rate	*	*	1.01	*	*	1.39	*	*	1.20
Crude Rate, 95% CI	*	*	0.9-1.1	*	*	1.2-1.5	*	*	1.1-1.3
Crude Rate Ratio		*	*		*	*		*	*
Crude Rate Ratio, 95% CI		*	*		*	*		*	*
Rate, Mean for all Years	*	*	1.02	*	*	1.39	*	*	1.20
p-value for T-test, Loudon rate different		*	*		*	*		*	*
Deaths (1990-2003)									
Number	6	0	176	0	1	222	6	1	398
Age Median (Range)	71 (1-93)	NA	59 (0-93)	NA	*	43.5 (0-94)	(1-93)	*	51 (0-94)
Crude Rate	2.28	0.00	0.45	0.00	0.00	0.60	1.18	0.19	0.53
Crude Rate, 95% CI	0.8-5	NA	0.4-0.5	NA	0-2.2	0.5-0.7	0.4-2.6	0-1.1	0.5-0.6

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Crude Rate Ratio		NA	5.06		NA	NA		6.22	2.24
Crude Rate Ratio, 95% CI		NA	2.24-11.43		NA	NA		0.75-51.65	1-5.02
Rate, Mean for all Years	2.36	0.00	0.45	0.00	0.37	0.61	1.22	0.18	0.53
p-value for T-test, Loudon rate different		0.0328	0.0757		0.3265	<.0001		0.0725	0.2000
Leukemia, Acute Monocytic									
Hospital Outpatients (1998-2003)									
Number	0	0	10	0	0	20	0	0	30
Age Median (Range)	NA	NA	19 (0-79)	NA	NA	30 (7-79)	*	*	22 (0-79)
Crude Rate	0.00	0.00	0.06	0.00	0.00	0.12	0.00	0.00	0.09
Crude Rate, 95% CI	NA	NA	NA.1	NA	NA	0.1-0.2	NA	NA	0.1-0.1
Crude Rate Ratio		NA	NA		NA	NA		NA	NA
Crude Rate Ratio, 95% CI		NA	NA		NA	NA		NA	NA
Rate, Mean for all Years	0.00	0.00	0.06	0.00	0.00	0.12	0.00	0.00	0.09
p-value for T-test, Loudon rate different		NA	0.0216		NA	0.0028		NA	0.0032
Hospital Inpatients (1997-2003)									
Number	0	1	45	0	1	45	0	2	90
Age Median (Range)	NA	*	65 (0-91)		*	66 (8-85)	NA	86 (*)	66 (0-91)
Crude Rate	0.00	0.71	0.22	0.00	0.75	0.23	0.00	0.73	0.23
Crude Rate, 95% CI	NA	0-4	0.2-0.3	NA	0-4.2	0.2-0.3	NA	0.1-2.6	0.2-0.3
Crude Rate Ratio		NA	NA		NA	NA		NA	NA
Crude Rate Ratio, 95% CI		NA	NA		NA	NA		NA	NA
Rate, Mean for all Years	0.00	0.71	0.22	0.00	0.77	0.23	0.00	0.74	0.23
p-value for T-test, Loudon rate different		0.5709	<.0001		0.7598	0.0006		0.4473	<.0001
TN Cancer Registry Incidence (1991-2000)									
Number	*	*	49	*	*	47	*	*	96
Age Median (Range)	*	*	64 (1-92)	*	*	14 (1-18)	*	*	67 (1-97)
Crude Rate	*	*	0.18	*	*	0.18	*	*	0.18
Crude Rate, 95% CI	*	*	0.1-0.2	*	*	0.1-0.2	*	*	0.1-0.2
Crude Rate Ratio		*	*		*	*		*	*
Crude Rate Ratio, 95% CI		*	*		*	*		*	*
Rate, Mean for all Years	*	*	0.18	*	*	0.18	*	*	0.18
p-value for T-test, Loudon rate different		*	*		*	*		*	*
Deaths (1990-2003)									

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Number	1	0	27	0	0	43	1	0	70
Age Median (Range)	*	NA	76 (30-89)	NA	NA	74 (11-97)	*	NA	74 (11-97)
Crude Rate	0.38	0.00	0.07	0.00	0.00	0.12	0.20	0.00	0.09
Crude Rate, 95% CI	0-2.1	NA	0-0.1	NA	NA	0.1-0.2	0-1.1	NA	0.1-0.1
Crude Rate Ratio		NA	5.50		NA	NA		NA	2.12
Crude Rate Ratio, 95% CI		NA	0.75-40.49		NA	NA		NA	0.29-15.28
Rate, Mean for all Years	0.39	0.00	0.07	0.00	0.00	0.12	0.20	0.00	0.09
p-value for T-test, Loudon rate different		0.3265	0.4257		NA	<.0001		0.3356	0.5993
Leukemia, Acute Myeloid									
Hospital Outpatients (1998-2003)									
Number	4	2	300	2	0	316	6	2	616
Age Median (Range)	64 (39-70)	41 (*)	43 (0-89)	44 (*)	NA	48 (1-91)	61 (26-70)	41 (*)	45 (0-91)
Crude Rate	3.30	1.65	1.71	1.74	0.00	1.89	2.54	0.85	1.80
Crude Rate, 95% CI	0.9-8.5	0.2-6	1.5-1.9	0.2-6.3	NA	1.7-2.1	0.9-5.5	0.1-3.1	1.7-1.9
Crude Rate Ratio		2.00	1.94		NA	0.92		3.00	1.41
Crude Rate Ratio, 95% CI		0.37-10.94	0.72-5.19		NA	0.23-3.69		0.61-14.89	0.63-3.16
Rate, Mean for all Years	3.27	1.65	1.70	1.73	0.00	1.89	2.52	0.85	1.79
p-value for T-test, Loudon rate different		0.5018	0.4839		0.1747	0.8882		0.2659	0.6054
Hospital Inpatients (1997-2003)									
Number	9	7	986	7	6	993	16	13	1979
Age Median (Range)	56 (32-81)	66 (57-92)	63 (0-98)	75 (25-87)	68 (2-81)	64 (0-98)	59 (25-87)	66 (2-92)	63 (0-98)
Crude Rate	6.41	4.96	4.83	5.27	4.49	5.13	5.85	4.73	4.98
Crude Rate, 95% CI	2.9-12.2	2-10.2	4.5-5.1	2.1-10.8	1.6-9.8	4.8-5.5	3.3-9.5	2.5-8.1	4.8-5.2
Crude Rate Ratio		1.29	1.33		1.17	1.03		1.24	1.18
Crude Rate Ratio, 95% CI		0.48-3.47	0.69-2.56		0.39-3.49	0.49-2.16		0.59-2.57	0.72-1.92
Rate, Mean for all Years	6.41	5.02	4.83	5.21	4.47	5.13	5.83	4.75	4.97
p-value for T-test, Loudon rate different		0.5710	0.3100		0.7598	0.9610		0.4472	0.4492
TN Cancer Registry Incidence (1991-2000)									
Number	6	*	639	8	7	624	14	11	1263
Age Median (Range)	70.5 (39-89)	*	66 (1-101)	64 (22-87)	61 (27-79)	67 (0-93)	66.5 (22-89)	62 (25-79)	67 (0-101)
Crude Rate	3.24	*	2.31	4.61	3.83	2.41	3.90	2.94	2.36
Crude Rate, 95% CI	1.2-7.1	*	2.1-2.5	1.9-9.1	1.5-7.9	2.2-2.6	2.1-6.5	1.5-5.3	2.2-2.5
Crude Rate Ratio		*	1.40		1.20	1.91		1.33	1.65

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Crude Rate Ratio, 95% CI		*	0.63-3.13		0.44-3.32	0.95-3.84		0.6-2.93	0.98-2.8
Rate, Mean for all Years	3.33	*	2.30	4.71	3.80	2.40	3.99	2.93	2.35
p-value for T-test, Loudon rate different		*	0.4373		0.7065	0.1673		0.4890	0.2281
Deaths (1990-2003)									
Number	4	5	844	6	11	928	10	16	1772
Age Median (Range)	71 (37-75)	71 (62-92)	72 (1-98)	73.5 (59-87)	66 (26-81)	69 (1-95)	71.5 (37-87)	68.5 (26-92)	71 (1-98)
Crude Rate	1.52	1.85	2.16	2.43	1.85	2.53	1.96	3.03	2.34
Crude Rate, 95% CI	0.4-3.9	0.6-4.3	2-2.3	0.9-5.3	2.1-7.6	2.4-2.7	0.9-3.6	1.7-4.9	2.2-2.4
Crude Rate Ratio		0.82	0.70		0.57	0.96		0.65	0.84
Crude Rate Ratio, 95% CI		0.22-3.07	0.26-1.88		0.21-1.54	0.43-2.14		0.29-1.43	0.45-1.56
Rate, Mean for all Years	1.53	1.78	2.15	2.48	4.18	2.51	1.99	2.95	2.33
p-value for T-test, Loudon rate different		0.8138	0.4715		0.2998	0.9698		0.3964	0.6183
Leukemia, Lymphoid									
Hospital Outpatients (1998-2003)									
Number	7	14	577	3	6	631	10	20	1208
Age Median (Range)	73 (55-87)	73 (64-86)	72 (4-102)	44 (*)	61 (35-95)	69 (4-99)	74 (55-87)	70 (35-95)	70 (4-102)
Crude Rate	5.78	11.53	3.28	2.61	5.22	3.78	4.24	8.46	3.53
Crude Rate, 95% CI	2.3-11.9	6.3-19.4	3-3.5	0.5-7.6	1.9-11.4	3.5-4.1	2-7.8	5.2-13.1	3.3-3.7
Crude Rate Ratio		0.50	1.76		0.50	0.69		0.50	1.20
Crude Rate Ratio, 95% CI		0.2-1.24	0.84-3.71		0.13-2	0.22-2.15		0.23-1.07	0.65-2.24
Rate, Mean for all Years	5.70	11.50	3.27	2.57	5.22	3.77	4.17	8.44	3.51
p-value for T-test, Loudon rate different		0.1128	0.3496		0.3891	0.3746		0.1441	0.7161
Hospital Inpatients (1997-2003)									
Number	15	18	1646	13	24	1962	28	42	3610
Age Median (Range)	82 (68-90)	79 (56-95)	78 (11-104)	75 (50-89)	77 (45-95)	74 (9-102)	76 (50-90)	78 (45-95)	76 (9-104)
Crude Rate	10.68	12.76	8.06	9.78	17.97	10.14	10.24	15.29	9.08
Crude Rate, 95% CI	6-17.6	7.6-20.2	7.7-8.5	5.2-16.7	11.5-26.7	9.7-10.6	6.8-14.8	11-20.7	8.8-9.4
Crude Rate Ratio		0.84	1.32		0.54	0.96		0.67	1.13
Crude Rate Ratio, 95% CI		0.42-1.66	0.8-2.2		0.28-1.07	0.56-1.66		0.42-1.08	0.78-1.64
Rate, Mean for all Years	10.70	12.70	8.07	9.72	17.98	10.15	10.22	15.27	9.08
p-value for T-test, Loudon rate different		0.6209	0.3517		0.0955	0.9001		0.1480	0.5780
TN Cancer Registry Incidence (1991-2000)									
Number	*	8	439	6	8	645	10	16	1084

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Age Median (Range)	*	75.5 (50-91)	72 (4-99)	76.5 (58-86)	66 (41-81)	69 (6-99)	71 (58-86)	72 (41-91)	71 (4-99)
Crude Rate	*	4.18	1.59	3.46	4.38	2.49	2.79	4.28	2.03
Crude Rate, 95% CI	*	1.8-8.2	1.4-1.7	1.3-7.5	1.8-8.6	2.3-2.7	1.3-5.1	2.4-6.9	1.9-2.1
Crude Rate Ratio		*	1.36		0.79	1.39		0.65	1.38
Crude Rate Ratio, 95% CI		*	0.51-3.64		0.27-2.27	0.62-3.1		0.3-1.44	0.74-2.57
Rate, Mean for all Years	*	4.13	1.58	3.37	4.28	2.49	2.75	4.20	2.02
p-value for T-test, Loudon rate different		*	0.6411		0.6240	0.4947		0.2831	0.3239
Deaths (1990-2003)									
Number	4	2	608	9	8	789	13	10	1397
Age Median (Range)	82.5 (58-88)	79.5 (*)	80 (4-105)	73 (65-90)	73.5 (51-88)	75 (39-106)	75 (58-90)	76.5 (51-88)	77 (4-106)
Crude Rate	1.52	0.74	1.56	3.64	0.74	2.15	2.55	1.89	1.84
Crude Rate, 95% CI	0.4-3.9	0.1-2.7	1.4-1.7	1.7-6.9	1.3-6.1	2-2.3	1.4-4.4	0.9-3.5	1.7-1.9
Crude Rate Ratio		2.06	0.98		1.17	1.69		1.35	1.38
Crude Rate Ratio, 95% CI		0.38-11.25	0.37-2.61		0.45-3.04	0.88-3.27		0.59-3.07	0.8-2.39
Rate, Mean for all Years	1.41	0.75	1.55	3.59	3.03	2.15	2.46	1.86	1.84
p-value for T-test, Loudon rate different		0.4950	0.8620		0.7085	0.2275		0.4727	0.3584
Leukemia, Monocytic									
Hospital Outpatients (1998-2003)									
Number	0	0	7	0	0	0	0	0	7
Age Median (Range)	NA	NA	40 (27-78)	NA	NA	NA	NA	NA	40 (27-78)
Crude Rate	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.02
Crude Rate, 95% CI	NA	NA	NA.1	NA	NA	NA	NA	NA	NA
Crude Rate Ratio		NA	NA		NA	NA		NA	NA
Crude Rate Ratio, 95% CI		NA	NA		NA	NA		NA	NA
Rate, Mean for all Years	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.02
p-value for T-test, Loudon rate different		NA	0.0127		NA	NA		NA	0.0127
Hospital Inpatients (1997-2003)									
Number	0	0	12	0	0	11	0	0	23
Age Median (Range)	NA	NA	73 (44-89)	NA	NA	74 (40-81)	NA	NA	74 (40-89)
Crude Rate	0.00	0.00	0.06	0.00	0.00	0.06	0.00	0.00	0.06
Crude Rate, 95% CI	NA	NA	0-0.1	NA	NA	0.03-0.1	NA	NA	0.04-0.09
Crude Rate Ratio		NA	NA		NA	NA		NA	NA
Crude Rate Ratio, 95% CI		NA	NA		NA	NA		NA	NA

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Rate, Mean for all Years	0.00	0.00	0.06	0.00	0.00	0.06	0.00	0.00	0.06
p-value for T-test, Loudon rate different		NA	0.0065		NA	0.0259		NA	0.0005
TN Cancer Registry Incidence (1991-2000)									
Number	*	*	*	*	*	*	*	*	6
Age Median (Range)	*	*	*	*	*	*	*	*	73 (56-83)
Crude Rate	*	*	*	*	*	*	*	*	0.01
Crude Rate, 95% CI	*	*	*	*	*	*	*	*	.004-.02
Crude Rate Ratio		*	*		*	*		*	*
Crude Rate Ratio, 95% CI		*	*		*	*		*	*
Rate, Mean for all Years	*	*	*	*	*	*	*	*	0.01
p-value for T-test, Loudon rate different		*	*		*	*		*	*
Deaths (1990-2003)									
Number	0	0	3	0	0	5	0	0	8
Age Median (Range)	NA	NA	85 (*)	NA	NA	68 (27-78)	NA	NA	70 (27-89)
Crude Rate	0.00	0.00	0.007	0.00	0.00	0.01	0.00	0.00	0.01
Crude Rate, 95% CI	NA	NA	0.001-0.02	NA	NA	0.004-0.03	NA	NA	0.004-0.02
Crude Rate Ratio		NA	NA		NA	NA		NA	NA
Crude Rate Ratio, 95% CI		NA	NA		NA	NA		NA	NA
Rate, Mean for all Years	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.01
p-value for T-test, Loudon rate different		NA	0.0828		NA	0.0526		NA	0.0271
Leukemia, Myeloid									
Hospital Outpatients (1998-2003)									
Number	1	0	215	0	2	202	1	2	417
Age Median (Range)	*		55 (0-97)	76 (73-79)	67 (*)	56 (1-92)	*	67 (*)	56 (0-97)
Crude Rate	0.83	0.00	1.22	0.00	1.74	1.21	0.42	0.85	1.22
Crude Rate, 95% CI	0-4.6	NA	1.1-1.4	NA	0.2-6.3	1-1.4	0-2.4	0.1-3.1	1.1-1.3
Crude Rate Ratio		NA	0.68		NA	NA		0.50	0.35
Crude Rate Ratio, 95% CI		NA	0.09-4.81		NA	NA		0.05-5.52	0.05-2.48
Rate, Mean for all Years	0.80	0.00	1.22	0.00	1.74	1.21	0.41	0.85	1.21
p-value for T-test, Loudon rate different		0.3632	0.6396		0.1450	0.0012		0.5339	0.1146
Hospital Inpatients (1997-2003)									
Number	1	8	504	1	10	534	2	18	1040
Age Median (Range)	*	71 (63-78)	69 (0-100)	*	79 (32-95)	65 (0-95)	55 (*)	75 (32-95)	67 (0-100)

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Crude Rate	0.71	5.67	2.47	0.75	7.49	2.76	0.73	6.55	2.62
Crude Rate, 95% CI	0-4	2.4-11.2	2.3-2.7	0-4.2	3.6-13.8	2.5-3	0.1-2.6	3.9-10.4	2.5-2.8
Crude Rate Ratio		0.13	0.29		0.10	0.27		0.11	0.28
Crude Rate Ratio, 95% CI		0.02-1	0.04-2.05		0.01-0.78	0.04-1.94		0.03-0.48	0.07-1.12
Rate, Mean for all Years	0.69	5.65	2.47	0.75	7.51	2.76	0.72	6.56	2.62
p-value for T-test, Loudon rate different		0.0245	0.0413		0.0121	0.0366		0.0001	0.0060
TN Cancer Registry Incidence (1991-2000)									
Number	*	*	270	*	*	340	*	6	610
Age Median (Range)	*	*	62 (6-95)	*	*	56 (38-74)	56 (38-74)	58.5 (31-89)	62 (2-95)
Crude Rate	*	*	0.98	*	*	1.31	*	*	1.14
Crude Rate, 95% CI	*	*	0.9-1.1	*	*	1.2-1.5	*	*	1-1.2
Crude Rate Ratio		*	*		*	*		*	*
Crude Rate Ratio, 95% CI		*	*		*	*		*	*
Rate, Mean for all Years	*	*	0.98	*	*	1.31	*	*	1.14
p-value for T-test, Loudon rate different		*	*		*	*		*	*
Deaths (1990-2003)									
Number	0	5	349	1	5	410	1	10	759
Age Median (Range)	NA	62 (34-86)	72 (1-100)	*	69 (62-95)	66 (0-95)	*	67.5 (34-95)	69 (0-100)
Crude Rate	0.00	1.85	0.89	0.40	1.85	1.12	0.20	1.89	1.00
Crude Rate, 95% CI	NA	0.6-4.3	0.8-1	0-2.3	0.6-4.5	1-1.2	0-1.1	0.9-3.5	0.9-1.1
Crude Rate Ratio		NA	NA		0.21	0.36		0.10	0.20
Crude Rate Ratio, 95% CI		NA	NA		0.02-1.79	0.05-2.58		0.01-0.81	0.03-1.39
Rate, Mean for all Years	0.00	1.89	0.90	0.42	1.89	1.12	0.20	1.89	1.01
p-value for T-test, Loudon rate different		0.0455	<.0001		0.0829	0.1180		0.0165	0.0016
Leukemia									
Hospital Outpatients (1998-2003)									
Number	5	2	615	6	9	561	11	11	1176
Age Median (Range)	72 (45-78)	66 (*)	59 (0-100)	75 (26-90)	66 (3-82)	63 (1-104)	72 (26-90)	66 (3-82)	62 (0-104)
Crude Rate	4.13	1.65	3.50	5.23	7.83	3.36	4.66	4.65	3.43
Crude Rate, 95% CI	1.3-9.6	0.2-6	3.2-3.8	1.9-11.4	3.6-14.9	3.1-3.6	2.3-8.3	2.3-8.3	3.2-3.6
Crude Rate Ratio		2.51	1.18		0.67	1.55		1.00	1.36
Crude Rate Ratio, 95% CI		0.49-12.91	0.49-2.85		0.24-1.87	0.69-3.47		0.43-2.31	0.75-2.46
Rate, Mean for all Years	4.07	1.67	3.48	5.16	7.84	3.36	4.60	4.67	3.42

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
p-value for T-test, Loudon rate different		0.2174	0.7202		0.5166	0.3918		0.9785	0.5103
Hospital Inpatients (1997-2003)									
Number	4	6	414	2	5	471	6	11	886
Age Median (Range)	56 (0-67)	74 (64-94)	74 (0-98)	56 (*)	75 (65-90)	71 (1-97)	56 (0-69)	75 (64-94)	72 (0-98)
Crude Rate	2.85	4.25	2.03	1.50	3.74	2.44	2.19	4.01	2.23
Crude Rate, 95% CI	0.8-7.3	1.6-9.3	1.8-2.2	0.2-5.4	1.2-8.7	2.2-2.7	0.8-4.8	2-7.2	2.1-2.4
Crude Rate Ratio		0.67	1.40		0.40	0.62		0.55	0.98
Crude Rate Ratio, 95% CI		0.19-2.37	0.52-3.76		0.08-2.07	0.15-2.48		0.2-1.48	0.44-2.2
Rate, Mean for all Years	2.84	4.28	2.03	1.53	3.72	2.43	2.20	4.01	2.23
p-value for T-test, Loudon rate different		0.4828	0.6087		0.2414	0.3954		0.1857	0.9706
TN Cancer Registry Incidence (1991-2000)									
Number	*	*	163	*	*	265	*	*	428
Age Median (Range)	*	*	68 (1-98)	*	*	68 (1-98)	*	*	65 (1-98)
Crude Rate	*	*	0.59	*	*	1.02	*	*	0.80
Crude Rate, 95% CI	*	*	0.5-0.7	*	*	0.9-1.1	*	*	0.7-0.9
Crude Rate Ratio		*	*		*	*		*	*
Crude Rate Ratio, 95% CI		*	*		*	*		*	*
Rate, Mean for all Years	*	*	0.60	*	*	1.04	*	*	0.81
p-value for T-test, Loudon rate different		*	*		*	*		*	*
Deaths (1990-2003)									
Number	9	5	723	4	8	794	13	13	1517
Age Median (Range)	64 (35-90)	57 (40-92)	76 (1-100)	74 (70-87)	71.5 (49-90)	72 (1-107)	70 (35-90)	68 (40-92)	74 (1-107)
Crude Rate	3.42	1.85	1.85	1.62	1.85	2.16	2.55	2.46	2.00
Crude Rate, 95% CI	1.6-6.5	0.6-4.3	1.7-2	0.4-4.1	1.3-6.1	2-2.3	1.4-4.4	1.3-4.2	1.9-2.1
Crude Rate Ratio		1.85	1.85		0.52	0.75		1.04	1.27
Crude Rate Ratio, 95% CI		0.62-5.53	0.96-3.57		0.16-1.73	0.28-2		0.48-2.24	0.74-2.2
Rate, Mean for all Years	3.58	1.91	1.86	1.60	3.06	2.17	2.63	2.46	2.01
p-value for T-test, Loudon rate different		0.2531	0.1445		0.3062	0.5320		0.8679	0.4333
Liver Malignancies									
Hospital Outpatients (1998-2003)									
Number	3	7	610	2	1	629	5	8	1239
Age Median (Range)	49 (*)	74 (36-76)	66 (0-95)	50 (*)	*	63 (1-92)	49 (46-52)	69 (36-76)	64 (0-95)
Crude Rate	2.48	5.77	3.47	1.74	0.87	3.77	2.12	3.39	3.62

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Crude Rate, 95% CI	0.5-7.2	2.3-11.9	3.2-3.7	0.2-6.3	0-4.8	3.5-4.1	0.7-4.9	1.4-6.7	3.4-3.8
Crude Rate Ratio		0.43	0.71		2.00	0.46		0.63	0.59
Crude Rate Ratio, 95% CI		0.11-1.66	0.23-2.22		0.18-22.08	0.12-1.85		0.2-1.91	0.24-1.41
Rate, Mean for all Years	2.45	5.74	3.45	1.73	0.88	3.76	2.10	3.38	3.60
p-value for T-test, Loudon rate different		0.2808	0.5867		0.5576	0.1302		0.4436	0.2749
Hospital Inpatients (1997-2003)									
Number	3	1	726	10	10	1079	13	11	1806
Age Median (Range)	86 (*)	*	71 (0-97)	69 (44-81)	71 (49-90)	64 (0-96)	71 (44-90)	72 (49-90)	67 (0-97)
Crude Rate	2.14	0.71	3.56	7.52	7.49	5.58	4.76	4.01	4.54
Crude Rate, 95% CI	0.4-6.2	0-4	3.3-3.8	3.6-13.8	3.6-13.8	5.2-5.9	2.5-8.1	2-7.2	4.3-4.8
Crude Rate Ratio		3.01	0.60		1.00	1.35		1.19	1.05
Crude Rate Ratio, 95% CI		0.31-28.96	0.19-1.87		0.42-2.41	0.72-2.51		0.53-2.65	0.61-1.81
Rate, Mean for all Years	2.21	0.70	3.56	7.48	7.50	5.56	4.78	4.01	4.53
p-value for T-test, Loudon rate different		0.3911	0.4153		0.9961	0.1065		0.6235	0.7496
TN Cancer Registry Incidence (1991-2000)									
Number	*	*	616	8	8	916	13	11	1532
Age Median (Range)	*	*	71 (0-96)	67.5 (48-74)	72 (49-95)	65 (0-99)	68 (29-90)	72 (45-95)	68 (0-99)
Crude Rate	*	*	2.23	4.61	4.38	3.53	3.62	2.94	2.86
Crude Rate, 95% CI	*	*	2.1-2.4	1.9-9.1	1.8-8.6	3.3-3.8	1.9-6.2	1.5-5.3	2.7-3
Crude Rate Ratio		*	1.21		1.05	1.30		1.23	1.27
Crude Rate Ratio, 95% CI		*	0.5-2.92		0.4-2.8	0.65-2.61		0.55-2.75	0.73-2.19
Rate, Mean for all Years	*	*	2.22	4.49	4.35	3.52	3.59	2.91	2.85
p-value for T-test, Loudon rate different		*	0.5938		0.9437	0.5718		0.5120	0.3286
Deaths (1990-2003)									
Number	14	6	1234	10	14	1863	24	20	3097
Age Median (Range)	75.5 (46-99)	68 (46-89)	74 (0-100)	65 (44-74)	74 (55-95)	68 (0-99)	71.5 (44-99)	74 (46-95)	70 (0-100)
Crude Rate	5.33	2.22	3.16	4.04	2.22	5.07	4.70	3.78	4.09
Crude Rate, 95% CI	2.9-8.9	0.8-4.8	3-3.3	1.9-7.4	3-9.1	4.8-5.3	3-7	2.3-5.8	3.9-4.2
Crude Rate Ratio		2.40	1.69		0.75	0.80		1.24	1.15
Crude Rate Ratio, 95% CI		0.92-6.25	1-2.85		0.33-1.68	0.43-1.48		0.69-2.25	0.77-1.72
Rate, Mean for all Years	5.56	2.22	3.15	3.92	5.38	5.03	4.77	3.76	4.06
p-value for T-test, Loudon rate different		0.2009	0.3241		0.3851	0.3843		0.4706	0.5631
Nasopharynx Malignancies									

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Hospital Outpatients (1998-2003)									
Number	1	0	74	1	0	103	2	0	177
Age Median (Range)	*	NA	57 (8-90)	*	NA	51 (13-93)	71 (*)	NA	53 (8-93)
Crude Rate	0.83	0.00	0.42	0.87	0.00	0.62	0.85	0.00	0.52
Crude Rate, 95% CI	0-4.6	NA	0.3-0.5	0-4.9	NA	0.5-0.7	0.1-3.1	NA	0.4-0.6
Crude Rate Ratio		NA	1.96		NA	1.41		NA	1.64
Crude Rate Ratio, 95% CI		NA	0.27-14.11		NA	0.2-10.11		NA	0.41-6.61
Rate, Mean for all Years	0.84	0.00	0.42	0.86	0.00	0.62	0.85	0.00	0.52
p-value for T-test, Loudon rate different		0.3632	0.6409		0.3632	0.7861		0.1747	0.5619
Hospital Inpatients (1997-2003)									
Number	0	0	105	0	0	175	0	0	280
Age Median (Range)	NA	NA	56 (5-99)	NA	NA	57 (13-86)	NA	NA	57 (5-99)
Crude Rate	0.00	0.00	0.51	0.00	0.00	0.90	0.00	0.00	0.70
Crude Rate, 95% CI	NA	NA	0.4-0.6	NA	NA	0.8-1	NA	NA	0.6-0.8
Crude Rate Ratio		NA	NA		NA	NA		NA	NA
Crude Rate Ratio, 95% CI		NA	NA		NA	NA		NA	NA
Rate, Mean for all Years	0.00	0.00	0.52	0.00	0.00	0.91	0.00	0.00	0.71
p-value for T-test, Loudon rate different		NA	<.0001		NA	<.0001		NA	<.0001
TN Cancer Registry Incidence (1991-2000)									
Number	*	*	99	*	*	189	*	*	288
Age Median (Range)	*	*	58 (10-94)	*	*	56 (3-91)	*	*	56 (3-94)
Crude Rate	*	*	0.36	*	*	0.73	*	*	0.54
Crude Rate, 95% CI	*	*	0.3-0.4	*	*	0.6-0.8	*	*	0.5-0.6
Crude Rate Ratio		*	*		*	0.79		*	*
Crude Rate Ratio, 95% CI		*	*		*	*		*	*
Rate, Mean for all Years	*	*	0.36	*	*	0.73	*	*	0.54
p-value for T-test, Loudon rate different		*	*		*	*		*	*
Deaths (1990-2003)									
Number	1	1	47	0	1	98	1	2	145
Age Median (Range)	*	*	64 (10-94)	NA	*	60.5 (13-87)	*	74.5 (*)	78 (2-99)
Crude Rate	0.38	0.37	0.12	0.00	0.37	0.27	0.20	0.38	0.19
Crude Rate, 95% CI	0-2.1	0-2.1	0.1-0.2	NA	0-2.2	0.2-0.3	0-1.1	0-1.4	0.2-0.2
Crude Rate Ratio		1.03	3.16		NA	NA		0.52	1.02

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Crude Rate Ratio, 95% CI		0.06-16.47	0.44-22.91		NA	NA		0.05-5.71	0.14-7.32
Rate, Mean for all Years	0.39	0.37	0.12	0.00	0.40	0.27	0.20	0.39	0.19
p-value for T-test, Loudon rate different		0.9694	0.5012		0.3265	<.0001		0.5802	0.9595
Ovary Malignancies									
Hospital Outpatients (1998-2003)									
Number	27	6	1863	NA	NA	NA	NA	NA	NA
Age Median (Range)	65 (40-79)	60 (45-73)	62 (6-94)	NA	NA	NA	NA	NA	NA
Crude Rate	22.29	4.94	10.60	NA	NA	NA	NA	NA	NA
Crude Rate, 95% CI	14.7-32.4	1.8-10.8	10.1-11.1	NA	NA	NA	NA	NA	NA
Crude Rate Ratio		4.51	2.10		NA	NA		NA	NA
Crude Rate Ratio, 95% CI		1.86-10.92	1.44-3.08		NA	NA		NA	NA
Rate, Mean for all Years	22.18	4.94	10.55	NA	NA	NA	NA	NA	NA
p-value for T-test, Loudon rate different		0.0047	0.0461		NA	NA		NA	NA
Hospital Inpatients (1997-2003)									
Number	54	32	4938	NA	NA	NA	NA	NA	NA
Age Median (Range)	65 (19-89)	68 (23-84)	65 (2-109)	NA	NA	NA	NA	NA	NA
Crude Rate	38.45	22.69	24.18	NA	NA	NA	NA	NA	NA
Crude Rate, 95% CI	28.9-50.2	15.5-32	23.5-24.9	NA	NA	NA	NA	NA	NA
Crude Rate Ratio		1.69	1.59		NA	NA		NA	NA
Crude Rate Ratio, 95% CI		1.09-2.62	1.22-2.08		NA	NA		NA	NA
Rate, Mean for all Years	38.48	22.74	24.17	NA	NA	NA	NA	NA	NA
p-value for T-test, Loudon rate different		0.0058	0.0014		NA	NA		NA	NA
TN Cancer Registry Incidence (1991-2000)									
Number	36	21	3782	NA	NA	NA	NA	NA	NA
Age Median (Range)	61.5 (19-79)	65 (23-81)	63 (5-109)	NA	NA	NA	NA	NA	NA
Crude Rate	19.45	10.96	13.70	NA	NA	NA	NA	NA	NA
Crude Rate, 95% CI	13.6-26.9	6.8-16.8	13.3-14.1	NA	NA	NA	NA	NA	NA
Crude Rate Ratio		1.77	1.42		NA	NA		NA	NA
Crude Rate Ratio, 95% CI		1.04-3.04	1.02-1.97		NA	NA		NA	NA
Rate, Mean for all Years	19.54	10.88	13.70	NA	NA	NA	NA	NA	NA
p-value for T-test, Loudon rate different		0.0599	0.1567		NA	NA		NA	NA
Deaths (1990-2003)									
Number	36	29	3900	NA	NA	NA	NA	NA	NA

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Age Median (Range)	67 (43-86)	75 (41-89)	71 (11-102)	NA	NA	NA	NA	NA	NA
Crude Rate	13.70	10.71	9.99	NA	NA	NA	NA	NA	NA
Crude Rate, 95% CI	9.6-19	7.2-15.4	9.7-10.3	NA	NA	NA	NA	NA	NA
Crude Rate Ratio		1.28	1.37		NA	NA		NA	NA
Crude Rate Ratio, 95% CI		0.78-2.08	0.99-1.9		NA	NA		NA	NA
Rate, Mean for all Years	13.72	10.74	9.97	NA	NA	NA	NA	NA	NA
p-value for T-test, Loudon rate different		0.3142	0.0938		NA	NA		NA	NA
Other Female Reproductive Malignancies									
Hospital Outpatients (1998-2003)									
Number	14	10	1710	NA	NA	NA	NA	NA	NA
Age Median (Range)	67 (38-90)	67 (31-85)	49 (0-97)	NA	NA	NA	NA	NA	NA
Crude Rate	11.56	8.24	9.73	NA	NA	NA	NA	NA	NA
Crude Rate, 95% CI	6.3-19.4	4-15.2	9.3-10.2	NA	NA	NA	NA	NA	NA
Crude Rate Ratio		1.40	1.19		NA	NA		NA	NA
Crude Rate Ratio, 95% CI		0.62-3.16	0.7-2.01		NA	NA		NA	NA
Rate, Mean for all Years	11.49	8.20	9.70	NA	NA	NA	NA	NA	NA
p-value for T-test, Loudon rate different		0.4545	0.6348		NA	NA		NA	NA
Hospital Inpatients (1997-2003)									
Number	24	24	3855	NA	NA	NA	NA	NA	NA
Age Median (Range)	52 (26-94)	72 (44-94)	54 (0-100)	NA	NA	NA	NA	NA	NA
Crude Rate	17.09	17.02	18.88	NA	NA	NA	NA	NA	NA
Crude Rate, 95% CI	10.9-25.4	10.9-25.3	18.3-19.5	NA	NA	NA	NA	NA	NA
Crude Rate Ratio		1.00	0.91		NA	NA		NA	NA
Crude Rate Ratio, 95% CI		0.57-1.77	0.61-1.35		NA	NA		NA	NA
Rate, Mean for all Years	17.05	17.03	18.90	NA	NA	NA	NA	NA	NA
p-value for T-test, Loudon rate different		0.9954	0.6546		NA	NA		NA	NA
TN Cancer Registry Incidence (1991-2000)									
Number	27	30	4246	NA	NA	NA	NA	NA	NA
Age Median (Range)	54 (27-88)	60.5 (22-89)	53 (1-99)	NA	NA	NA	NA	NA	NA
Crude Rate	14.59	15.66	15.38	NA	NA	NA	NA	NA	NA
Crude Rate, 95% CI	9.6-21.2	10.6-22.4	14.9-15.8	NA	NA	NA	NA	NA	NA
Crude Rate Ratio		0.93	0.95		NA	NA		NA	NA
Crude Rate Ratio, 95% CI		0.55-1.57	0.65-1.38		NA	NA		NA	NA

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Rate, Mean for all Years	14.62	15.74	15.41	NA	NA	NA	NA	NA	NA
p-value for T-test, Loudon rate different		0.8268	0.7557		NA	NA		NA	NA
Deaths (1990-2003)									
Number	20	12	1995	NA	NA	NA	NA	NA	NA
Age Median (Range)	64.5 (36-91)	65 (34-93)	63 (15-100)	NA	NA	NA	NA	NA	NA
Crude Rate	7.61	4.43	5.11	NA	NA	NA	NA	NA	NA
Crude Rate, 95% CI	4.6-11.8	2.3-7.7	4.9-5.3	NA	NA	NA	NA	NA	NA
Crude Rate Ratio		1.72	1.49		NA	NA		NA	NA
Crude Rate Ratio, 95% CI		0.84-3.51	0.96-2.31		NA	NA		NA	NA
Rate, Mean for all Years	7.78	4.45	5.12	NA	NA	NA	NA	NA	NA
p-value for T-test, Loudon rate different		0.0488	0.0794		NA	NA		NA	NA
Prostate Malignancies									
Hospital Outpatients (1998-2003)									
Number	NA	NA	NA	68	89	7595	NA	NA	NA
Age Median (Range)	NA	NA	NA	73 (53-94)	70 (41-90)	72 (7-104)			
Crude Rate	NA	NA	NA	59.22	77.44	45.54	NA	NA	NA
Crude Rate, 95% CI	NA	NA	NA	46-75.1	62.2-95.3	44.5-46.6	NA	NA	NA
Crude Rate Ratio		NA	NA		0.76	1.30		NA	NA
Crude Rate Ratio, 95% CI		NA	NA		0.56-1.05	1.02-1.65		NA	NA
Rate, Mean for all Years	NA	NA	NA	59.25	77.40	45.49	NA	NA	NA
p-value for T-test, Loudon rate different		NA	NA		0.2076	0.0971		NA	NA
Hospital Inpatients (1997-2003)									
Number	NA	NA	NA	246	213	23303	NA	NA	NA
Age Median (Range)	NA	NA	NA	69 (41-96)	72 (46-93)	71 (2-103)	NA	NA	NA
Crude Rate	NA	NA	NA	185.04	159.46	120.48	NA	NA	NA
Crude Rate, 95% CI	NA	NA	NA	161.9-208.2	138-180.9	118.9-122	NA	NA	NA
Crude Rate Ratio		NA	NA		1.16	1.54		NA	NA
Crude Rate Ratio, 95% CI		NA	NA		0.97-1.39	1.35-1.74		NA	NA
Rate, Mean for all Years	NA	NA	NA	184.86	159.76	120.49	NA	NA	NA
p-value for T-test, Loudon rate different		NA	NA		0.1522	0.0002		NA	NA
TN Cancer Registry Incidence (1991-2000)									
Number	NA	NA	NA	266	191	25750	NA	NA	NA
Age Median (Range)	NA	NA	NA	68 (1-90)	70 (46-94)	69 (1-104)	NA	NA	NA

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Crude Rate	NA	NA	NA	161.86	104.53	99.35	NA	NA	NA
Crude Rate, 95% CI	NA	NA	NA	142.9-180.8	89.7-119.4	98.1-100.6	NA	NA	NA
Crude Rate Ratio		NA	NA		1.55	1.63		NA	NA
Crude Rate Ratio, 95% CI		NA	NA		1.29-1.86	1.45-1.83		NA	NA
Rate, Mean for all Years	NA	NA	NA	153.13	103.97	99.64	NA	NA	NA
p-value for T-test, Loudon rate different		NA	NA		0.0056	0.0022		NA	NA
Deaths (1990-2003)									
Number	NA	NA	NA	75	97	9229	NA	NA	NA
Age Median (Range)	NA	NA	NA	76 (55-95)	78 (58-96)	78 (8-111)	NA	NA	NA
Crude Rate	NA	NA	NA	30.33	0.00	25.12	NA	NA	NA
Crude Rate, 95% CI	NA	NA	NA	23.9-38	30.5-45.9	24.6-25.6	NA	NA	NA
Crude Rate Ratio		NA	NA		0.81	1.21		NA	NA
Crude Rate Ratio, 95% CI		NA	NA		0.6-1.09	0.96-1.52		NA	NA
Rate, Mean for all Years	NA	NA	NA	30.55	37.66	25.24	NA	NA	NA
p-value for T-test, Loudon rate different		NA	NA		0.2284	0.3140		NA	NA
Rectum Malignancies									
Hospital Outpatients (1998-2003)									
Number	12	8	1448	9	9	1546	21	17	2994
Age Median (Range)	58 (38-80)	60 (37-71)	64 (11-101)	74 (34-83)	65 (47-82)	63 (21-99)	60 (34-83)	62 (37-82)	63 (11-101)
Crude Rate	9.91	6.59	8.24	7.84	7.83	9.27	8.90	7.19	8.74
Crude Rate, 95% CI	5.1-17.3	2.8-13	7.8-8.7	3.6-14.9	3.6-14.9	8.8-9.7	5.5-13.6	4.2-11.5	8.4-9.1
Crude Rate Ratio		1.50	1.20		1.00	0.85		1.24	1.02
Crude Rate Ratio, 95% CI		0.61-3.68	0.68-2.12		0.4-2.52	0.44-1.63		0.65-2.34	0.66-1.56
Rate, Mean for all Years	9.95	6.56	8.21	7.77	7.83	9.27	8.90	7.18	8.73
p-value for T-test, Loudon rate different		0.2493	0.4929		0.9882	0.6458		0.0951	0.8534
Hospital Inpatients (1997-2003)									
Number	29	10	3083	40	32	3621	69	42	6705
Age Median (Range)	69 (39-89)	69 (38-93)	69 (10-100)	72 (34-92)	71 (47-87)	66 (19-100)	70 (34-92)	70 (38-93)	67 (10-100)
Crude Rate	20.65	7.09	15.10	30.09	23.96	18.72	25.24	15.29	16.86
Crude Rate, 95% CI	13.8-29.7	3.4-13	14.6-15.6	21.5-41	16.4-33.8	18.1-19.3	19.6-31.9	11-20.7	16.5-17.3
Crude Rate Ratio		2.91	1.37		1.26	1.61		1.65	1.50
Crude Rate Ratio, 95% CI		1.42-5.98	0.95-1.97		0.79-2	1.18-2.19		1.12-2.42	1.18-1.9
Rate, Mean for all Years	20.81	7.14	15.09	30.13	24.02	18.72	25.35	15.35	16.86

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
p-value for T-test, Loudon rate different		0.0187	0.2422		0.2885	0.0199		0.0299	0.0266
TN Cancer Registry Incidence (1991-2000)									
Number	35	10	2997	33	20	3680	68	30	6677
Age Median (Range)	65 (39-86)	54 (35-86)	68 (10-100)	65 (23-83)	71.5 (32-85)	66 (19-99)	65 (23-86)	68.5 (32-86)	67 (10-100)
Crude Rate	18.91	5.22	10.86	19.01	10.95	14.20	18.96	8.02	12.47
Crude Rate, 95% CI	13.2-26.3	2.5-9.6	10.5-11.2	13.1-26.7	6.7-16.9	13.7-14.7	14.7-24	5.4-11.4	12.2-12.8
Crude Rate Ratio		3.62	1.74		1.74	1.34		2.37	1.52
Crude Rate Ratio, 95% CI		1.79-7.31	1.25-2.43		1-3.03	0.95-1.89		1.54-3.63	1.2-1.93
Rate, Mean for all Years	19.04	5.24	10.87	18.99	10.89	14.19	19.02	0.81	12.48
p-value for T-test, Loudon rate different		0.0002	0.0072		0.0175	0.0900		0.0002	0.0074
Deaths (1990-2003)									
Number	8	5	1079	9	9	1190	17	14	2269
Age Median (Range)	77.5 (51-89)	78 (57-83)	74 (23-112)	72 (54-87)	69 (48-87)	69 (25-97)	72 (51-89)	70.5 (48-87)	71 (23-112)
Crude Rate	3.04	1.85	2.76	3.64	1.85	3.24	3.33	2.65	2.99
Crude Rate, 95% CI	1.3-6	0.6-4.3	2.6-2.9	1.7-6.9	1.6-6.6	3.1-3.4	1.9-5.3	1.4-4.4	2.9-3.1
Crude Rate Ratio		1.65	1.10		1.04	1.12		1.26	1.11
Crude Rate Ratio, 95% CI		0.54-5.04	0.55-2.21		0.41-2.63	0.58-2.16		0.62-2.55	0.69-1.79
Rate, Mean for all Years	3.19	1.94	2.77	3.59	1.20	3.23	3.39	2.67	2.99
p-value for T-test, Loudon rate different		0.4063	0.7221		0.9096	0.7025		0.4421	0.5181
Sinus Malignancies									
Hospital Outpatients (1998-2003)									
Number	1	0	91	1	0	139	2	0	230
Age Median (Range)	*	NA	63 (7-100)	*	NA	61 (1-98)	64 (*)	NA	62 (1-100)
Crude Rate	0.83	0.00	0.52	0.87	0.00	0.83	0.85	0.00	0.67
Crude Rate, 95% CI	0-4.6	NA	0.4-0.6	0-4.9	NA	0.7-1	0.1-3.1	NA	0.6-0.8
Crude Rate Ratio		NA	1.60		NA	1.04		NA	1.26
Crude Rate Ratio, 95% CI		NA	0.22-11.45		NA	0.15-7.47		NA	0.31-5.08
Rate, Mean for all Years	0.80	0.00	0.52	0.89	0.00	0.83	0.84	0.00	0.67
p-value for T-test, Loudon rate different		0.3632	0.7382		0.3632	0.9547		0.1748	0.7634
Hospital Inpatients (1997-2003)									
Number	0	0	116	0	2	179	0	2	295
Age Median (Range)	NA	NA	67 (7-96)	NA	53 (*)	64 (1-95)		53 (*)	65 (1-96)
Crude Rate	0.00	0.00	0.57	0.00	1.50	0.93	0.00	0.73	0.74

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Crude Rate, 95% CI	NA	NA	0.5-0.7	NA	0.2-5.4	0.8-1.1	NA	0.1-2.6	0.7-0.8
Crude Rate Ratio		NA	NA		NA	NA		NA	NA
Crude Rate Ratio, 95% CI		NA	NA		NA	NA		NA	NA
Rate, Mean for all Years	0.00	0.00	0.57	0.00	1.49	0.93	0.00	0.73	0.74
p-value for T-test, Loudon rate different		NA	0.0003		0.1473	<.0001		0.1473	<.0001
TN Cancer Registry Incidence (1991-2000)									
Number	*	*	100	*	*	131	*	*	231
Age Median (Range)	*	*	67.5 (12-93)	*	*	63 (1-89)	*	*	64 (1-93)
Crude Rate	*	*	0.36	*	*	0.51	*	*	0.43
Crude Rate, 95% CI	*	*	0.3-0.4	*	*	0.4-0.6	*	*	0.4-0.5
Crude Rate Ratio		*	*		*	*		*	*
Crude Rate Ratio, 95% CI		*	*		*	*		*	*
Rate, Mean for all Years	*	*	0.36	*	*	0.51	*	*	0.43
p-value for T-test, Loudon rate different		*	*		*	*		*	*
Deaths (1990-2003)									
Number	0	1	60	1	3	105	1	4	165
Age Median (Range)	NA	*	74.5 (1-95)	*	75 (*)	69 (17-93)	*	72.5 (52-80)	71 (1-95)
Crude Rate	0.00	0.37	0.15	0.40	0.37	0.29	0.20	0.76	0.22
Crude Rate, 95% CI	NA	0-2.1	0.1-0.2	0-2.3	0.2-3.4	0.2-0.3	0-1.1	0.2-1.9	0.2-0.3
Crude Rate Ratio		NA	NA		0.35	1.41		0.26	0.90
Crude Rate Ratio, 95% CI		NA	NA		0.04-3.34	0.2-10.14		0.03-2.32	0.13-6.43
Rate, Mean for all Years	0.00	0.38	0.15	0.42	0.37	0.29	0.20	0.78	0.22
p-value for T-test, Loudon rate different		0.3265	<.0001		0.3136	0.7602		0.1577	0.9389
Thyroid Malignancies									
Hospital Outpatients (1998-2003)									
Number	4	3	824	1	1	240	5	4	1064
Age Median (Range)	56 (49-68)	54 (*)	46 (12-94)	*	*	54 (1-85)	54 (40-68)	51 (42-84)	48 (1-94)
Crude Rate	3.30	2.47	4.69	0.87	0.87	1.44	2.12	1.69	3.11
Crude Rate, 95% CI	0.9-8.5	0.5-7.2	4.4-5	0-4.9	0-4.8	1.3-1.6	0.7-4.9	0.5-4.3	2.9-3.3
Crude Rate Ratio		1.34	0.70		1.00	0.61		1.25	0.68
Crude Rate Ratio, 95% CI		0.3-5.97	0.26-1.88		0.06-16	0.08-4.31		0.34-4.66	0.28-1.64
Rate, Mean for all Years	3.33	2.46	4.66	0.89	0.88	1.44	2.14	1.69	30.90
p-value for T-test, Loudon rate different		0.7201	0.4996		0.9948	0.5720		0.7694	0.4910

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Hospital Inpatients (1997-2003)									
Number	15	12	1774	6	3	699	21	15	2473
Age Median (Range)	52 (16-75)	53 (37-93)	47 (4-98)	62 (18-74)	67 (*)	54 (2-96)	56 (16-75)	61 (37-93)	49 (2-98)
Crude Rate	10.68	8.51	8.69	4.51	2.25	3.61	7.68	5.46	6.22
Crude Rate, 95% CI	6-17.6	4.4-14.9	8.3-9.1	1.7-9.8	0.5-6.6	3.3-3.9	4.8-11.7	3.1-9	6-6.5
Crude Rate Ratio		1.26	1.23		2.01	1.25		1.41	1.24
Crude Rate Ratio, 95% CI		0.59-2.68	0.74-2.04		0.5-8.03	0.56-2.79		0.72-2.73	0.8-1.9
Rate, Mean for all Years	10.71	8.49	8.69	4.56	2.22	3.62	7.72	5.44	6.22
p-value for T-test, Loudon rate different		0.5138	0.2931		0.2050	0.5266		0.2902	0.3313
TN Cancer Registry Incidence (1991-2000)									
Number	14	11	1960	6	6	669	20	17	2629
Age Median (Range)	51.5 (16-75)	42 (26-82)	46 (4-97)	50 (33-73)	51 (1-92)	51 (1-92)	51.5 (16-75)	46 (26-82)	47 (1-97)
Crude Rate	7.57	5.74	7.10	3.46	3.28	2.58	5.58	4.54	4.91
Crude Rate, 95% CI	4.1-12.7	2.9-10.3	6.8-7.4	1.3-7.5	1.2-7.1	2.4-2.8	3.4-8.6	2.6-7.3	4.7-5.1
Crude Rate Ratio		1.32	1.07		1.05	1.34		1.23	1.14
Crude Rate Ratio, 95% CI		0.6-2.9	0.63-1.8		0.34-3.26	0.6-2.99		0.64-2.34	0.73-1.76
Rate, Mean for all Years	7.35	5.73	7.05	3.29	3.31	2.55	5.38	4.55	4.87
p-value for T-test, Loudon rate different		0.5037	0.8582		0.9898	0.5598		0.5881	0.6648
Deaths (1990-2003)									
Number	0	1	186	0	1	118	0	2	304
Age Median (Range)	NA	*	76 (14-100)	NA	*	70 (5-95)	NA	73 (*)	75 (5-100)
Crude Rate	0.00	0.37	0.48	0.00	0.37	0.32	0.00	0.38	0.40
Crude Rate, 95% CI	NA	0-2.1	0.4-0.5	NA	0-2.2	0.3-0.4	NA	0-1.4	0.4-0.4
Crude Rate Ratio		NA	NA		NA	NA		NA	NA
Crude Rate Ratio, 95% CI		NA	NA		NA	NA		NA	NA
Rate, Mean for all Years	0.00	0.35	0.47	0.00	0.40	0.32	0.00	0.36	0.40
p-value for T-test, Loudon rate different		0.3265	<.0001		0.3265	<.0001		0.3265	<.0001
Trachea Malignancies									
Hospital Outpatients (1998-2003)									
Number	0	2	20	1	0	25	1	2	45
Age Median (Range)		66 (*)	56 (30-89)	*	*	61 (46-85)	*	66 (*)	59 (30-89)
Crude Rate	0.00	1.65	0.11	0.87	0.00	0.15	0.42	0.85	0.13
Crude Rate, 95% CI	NA	0.2-6	0.1-0.2	0-4.9	NA	0.1-0.2	0-2.4	0.1-3.1	0.1-0.2

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Crude Rate Ratio		NA	NA		NA	5.81		0.50	3.23
Crude Rate Ratio, 95% CI		NA	NA		NA	0.79-42.88		0.05-5.52	0.44-23.41
Rate, Mean for all Years	0.00	1.63	0.11	0.85	0.00	0.15	0.42	0.84	0.13
p-value for T-test, Loudon rate different		0.1449	0.0143		0.3632	0.4469		0.5461	0.5237
Hospital Inpatients (1997-2003)									
Number	0	0	38	1	0	48	1	0	86
Age Median (Range)	NA	NA	59 (34-87)	*	NA	60 (40-86)	*		60 (34-87)
Crude Rate	0.00	0.00	0.19	0.75	0.00	0.25	0.37	0.00	0.22
Crude Rate, 95% CI	NA	NA	0.1-0.3	0-4.2	NA	0.2-0.3	0-2	NA	0.2-0.3
Crude Rate Ratio		NA	NA		NA	3.03		NA	1.69
Crude Rate Ratio, 95% CI		NA	NA		NA	0.42-21.96		NA	0.24-12.14
Rate, Mean for all Years	0.00	0.00	0.19	0.75	0.00	0.25	0.37	0.00	0.22
p-value for T-test, Loudon rate different		NA	0.0006		0.3559	0.5287		0.3559	0.6970
TN Cancer Registry Incidence (1991-2000)									
Number	*	*	17	*	*	30	*	*	47
Age Median (Range)	*	*	61 (30-88)	*	*	62.5 (23-79)	*	*	61 (23-88)
Crude Rate	*	*	0.06	*	*	0.12	*	*	0.09
Crude Rate, 95% CI	*	*	0.01-0.1	*	*	0.1-0.2	*	*	0.01-0.1
Crude Rate Ratio		*	*		*	*		*	*
Crude Rate Ratio, 95% CI		*	*		*	*		*	*
Rate, Mean for all Years	*	*	0.06	*	*	0.12	*	*	0.09
p-value for T-test, Loudon rate different		*	*		*	*		*	*
Deaths (1990-2003)									
Number	0	1	6	0	0	17	0	1	23
Age Median (Range)	NA	*	61.5 (34-82)	NA	NA	59 (39-84)	NA	*	59 (34-84)
Crude Rate	NA	0.37	0.02	0.00	0.00	0.05	0.00	0.19	0.03
Crude Rate, 95% CI	NA	0-2.1	0-0.1	NA	NA	0-0.1	NA	0-1.1	0-0.1
Crude Rate Ratio		NA	NA		NA	NA		NA	NA
Crude Rate Ratio, 95% CI		NA	NA		NA	NA		NA	NA
Rate, Mean for all Years	0.00	0.37	0.01		0.00	0.05	0.00	0.18	0.03
p-value for T-test, Loudon rate different		0.3265	0.0267		NA	0.0004		0.3265	<.0001
Uterine Malignancies									
Hospital Outpatients (1998-2003)									

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Number	20	11	1223	NA	NA	NA	NA	NA	NA
Age Median (Range)	59 (35-84)	66 (45-89)	63 (21-104)	NA	NA	NA	NA	NA	NA
Crude Rate	16.51	9.06	6.96	NA	NA	NA	NA	NA	NA
Crude Rate, 95% CI	10.1-25.5	4.5-16.2	6.6-7.3	NA	NA	NA	NA	NA	NA
Crude Rate Ratio		1.82	2.37		NA	NA		NA	NA
Crude Rate Ratio, 95% CI		0.87-3.8	1.53-3.69		NA	NA		NA	NA
Rate, Mean for all Years	16.34	9.07	6.93	NA	NA	NA	NA	NA	NA
p-value for T-test, Loudon rate different		0.2583	0.1449		NA	NA		NA	NA
Hospital Inpatients (1997-2003)									
Number	57	32	5009	NA	NA	NA	NA	NA	NA
Age Median (Range)	63 (33-89)	68 (39-86)	64 (14-103)	NA	NA	NA	NA	NA	NA
Crude Rate	40.59	22.69	24.53	NA	NA	NA	NA	NA	NA
Crude Rate, 95% CI	30.7-52.6	15.5-32	23.9-25.2	NA	NA	NA	NA	NA	NA
Crude Rate Ratio		1.79	1.65		NA	NA		NA	NA
Crude Rate Ratio, 95% CI		1.16-2.76	1.27-2.15		NA	NA		NA	NA
Rate, Mean for all Years	40.59	22.71	24.54	NA	NA	NA	NA	NA	NA
p-value for T-test, Loudon rate different		0.0482	0.0454		NA	NA		NA	NA
TN Cancer Registry Incidence (1991-2000)									
Number	60	36	5816	NA	NA	NA	NA	NA	NA
Age Median (Range)	65 (28-89)	70 (41-89)	65 (14-99)	NA	NA	NA	NA	NA	NA
Crude Rate	32.42	18.80	21.07	NA	NA	NA	NA	NA	NA
Crude Rate, 95% CI	24.7-41.7	13.2-26	20.5-21.6	NA	NA	NA	NA	NA	NA
Crude Rate Ratio		1.73	1.54		NA	NA		NA	NA
Crude Rate Ratio, 95% CI		1.14-2.61	1.19-1.98		NA	NA		NA	NA
Rate, Mean for all Years	32.31	18.70	21.10	NA	NA	NA	NA	NA	NA
p-value for T-test, Loudon rate different		0.0151	0.0024		NA	NA		NA	NA
Deaths (1990-2003)									
Number	19	17	1732	NA	NA	NA	NA	NA	NA
Age Median (Range)	73 (56-87)	76 (57-91)	72 (29-102)	NA	NA	NA	NA	NA	NA
Crude Rate	7.23	6.28	4.44	NA	NA	NA	NA	NA	NA
Crude Rate, 95% CI	4.4-11.3	3.7-10.1	4.2-4.6	NA	NA	NA	NA	NA	NA
Crude Rate Ratio		1.15	1.63		NA	NA		NA	NA
Crude Rate Ratio, 95% CI		0.6-2.21	1.04-2.56		NA	NA		NA	NA

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Rate, Mean for all Years	7.17	6.24	4.45	NA	NA	NA	NA	NA	NA
p-value for T-test, Loudon rate different		0.7119	0.2054		NA	NA		NA	NA
All Malignancies									
Hospital Outpatients (1998-2003)									
Number	780	651	86433	677	672	73120	1457	1323	159556
Age Median (Range)	64 (0-96)	66 (14-105)	62 (0-111)	66 (0-98)	66 (1-95)	65 (0-106)	65 (0-98)	66 (1-105)	63 (0-111)
Crude Rate	643.93	536.30	491.57	589.60	584.69	438.43	617.49	559.83	465.71
Crude Rate, 95% CI	598.7-689.1	495.1-577.5	488.3-494.8	545.2-634	540.5-628.9	435.2-441.6	585.8-649.2	529.7-590	463.4-468
Crude Rate Ratio		1.20	1.31		1.01	1.34		1.10	1.33
Crude Rate Ratio, 95% CI		1.08-1.33	1.22-1.41		0.91-1.12	1.25-1.45		1.02-1.19	1.26-1.4
Rate, Mean for all Years	642.74	535.82	490.82	591.34	584.98	438.90	617.61	559.75	617.61
p-value for T-test, Loudon rate different		0.0660	0.0103		0.9330	0.0493		0.1511	0.0003
Hospital Inpatients (1997-2003)									
Number	1124	881	121560	1235	1068	124802	2359	1949	246410
Age Median (Range)	67 (0-102)	71 (14-98)	67 (0-109)	67 (1-96)	70 (1-98)	67 (0-105)	67 (0-102)	70 (1-98)	67 (0-109)
Crude Rate	800.36	624.71	595.36	928.94	799.54	645.22	862.89	709.75	619.74
Crude Rate, 95% CI	753.6-847.2	583.5-666	592-598.7	877.1-980.8	751.6-847.5	641.6-648.8	828.1-897.7	678.2-741.3	617.3-622.2
Crude Rate Ratio		1.28	1.34		1.16	1.44		1.22	1.39
Crude Rate Ratio, 95% CI		1.17-1.4	1.27-1.43		1.07-1.26	1.36-1.52		1.15-1.29	1.34-1.45
Rate, Mean for all Years	801.01	625.19	595.55	930.47	800.30	645.38	863.96	710.37	619.92
p-value for T-test, Loudon rate different		0.0001	0.0002		0.0063	<.0001		0.0002	<.0001
TN Cancer Registry Incidence (1991-2000)									
Number	931	639	103984	1054	753	105638	1985	1392	209625
Age Median (Range)	65 (2-95)	67 (12-96)	65 (0-109)	66 (1-94)	68 (0-95)	67 (0-109)	66 (1-95)	68 (0-96)	66 (0-109)
Crude Rate	503.09	333.62	376.64	607.10	412.09	407.59	553.44	371.93	391.63
Crude Rate, 95% CI	470.8-535.4	307.8-359.5	374.3-378.9	570.4-643.8	382.7-441.5	405.1-410.1	529.1-577.8	352.4-391.5	390-393.3
Crude Rate Ratio		1.51	1.34		1.47	1.49		1.49	1.41
Crude Rate Ratio, 95% CI		1.36-1.67	1.25-1.42		1.34-1.62	1.4-1.58		1.39-1.59	1.35-1.48
Rate, Mean for all Years	501.41	331.57	376.18	606.40	409.46	407.79	552.23	369.57	391.47
p-value for T-test, Loudon rate different		<.0001	0.0003		0.0002	<.0001		<.0001	<.0001
Deaths (1990-2003)									
Number	595	532	74672	712	743	88307	1307	1275	162980
Age Median (Range)	72 (1-99)	71 (5-98)	71 (0-112)	70 (26-101)	72 (3-99)	70 (0-111)	71 (1-101)	72 (3-99)	71 (0-112)

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Crude Rate	226.39	196.54	191.25	287.91	196.54	240.36	256.21	241.17	215.06
Crude Rate, 95% CI	208.2-244.6	179.8-213.2	189.9-192.6	266.8-309.1	267.3-308.7	238.8-241.9	242.3-270.1	227.9-254.4	214-216.1
Crude Rate Ratio		1.15	1.18		1.00	1.20		1.06	1.19
Crude Rate Ratio, 95% CI		1.02-1.29	1.09-1.28		0.9-1.11	1.11-1.29		0.98-1.15	1.13-1.26
Rate, Mean for all Years	225.60	199.18	191.07	287.98	287.41	240.59	255.80	240.70	215.06
p-value for T-test, Loudon rate different		0.0268	0.0008		0.9674	<.0001		0.0647	<.0001
RESPIRATORY ILLNESSES									
Acute Upper Respiratory Infections									
Hospital Outpatients (1998-2003)									
Number	5111	4153	502421	3426	2757	333147	8537	6910	835610
Age Median (Range)	21 (0-96)	22 (0-95)	21 (0-106)	10 (0-95)	13 (0-95)	11 (0-112)	18 (0-96)	19 (0-95)	18 (0-112)
Crude Rate	4219.36	3421.29	2857.39	2983.70	2398.79	1997.55	3618.05	2924.00	2438.95
Crude Rate, 95% CI	4103.7-4335	3317.2-3525.3	2849.5-2865.3	2883.8-3083.6	2309.2-2488.3	1990.8-2004.3	3541.3-3694.8	2855.1-2992.9	2433.7-2444.2
Crude Rate Ratio		1.23	1.48		1.24	1.49		1.24	1.48
Crude Rate Ratio, 95% CI		1.18-1.28	1.44-1.52		1.18-1.31	1.44-1.54		1.2-1.28	1.45-1.51
Rate, Mean for all Years	4208.55	3417.35	2848.44	29856.00	2401.16	1996.31	3613.23	2923.28	2433.38
p-value for T-test, Loudon rate different		0.0558	0.0109		0.0620	0.0039		0.0034	0.0008
Hospital Inpatients (1997-2003)									
Number	374	484	47473	315	383	38540	689	867	86020
Age Median (Range)	58 (0-96)	55 (0-99)	46 (0-107)	32 (0-96)	34 (0-95)	12 (0-107)	47 (0-96)	47 (0-99)	36 (0-107)
Crude Rate	266.31	343.20	232.51	236.94	286.73	199.25	252.03	315.73	216.35
Crude Rate, 95% CI	239.3-293.3	312.6-373.8	230.4-234.6	210.8-263.1	258-315.4	197.3-201.2	233.2-270.8	294.7-336.7	214.9-217.8
Crude Rate Ratio		0.78	1.15		0.83	1.19		0.80	1.16
Crude Rate Ratio, 95% CI		0.68-0.89	1.03-1.27		0.71-0.96	1.06-1.33		0.72-0.88	1.08-1.26
Rate, Mean for all Years	266.66	343.64	232.62	237.07	286.53	199.47	252.29	315.85	216.51
p-value for T-test, Loudon rate different		0.0206	0.0913		0.0718	0.0805		0.0084	0.0309
Deaths (1990-2003)									
Number	1	4	140	0	0	76	1	4	216
Age Median (Range)	*	84 (45-91)	78 (0-106)	NA	NA	64.5 (0-102)	*	84 (45-91)	74.5 (0-106)
Crude Rate	0.38	1.48	0.36	0.00	1.48	0.21	0.20	0.76	0.29
Crude Rate, 95% CI	0-2.1	0.4-3.8	0.3-0.4	NA	NA	0.2-0.3	0-1.1	0.2-1.9	0.2-0.3
Crude Rate Ratio		0.26	1.06		NA	NA		0.26	0.69
Crude Rate Ratio, 95% CI		0.03-2.3	0.15-7.59		NA	NA		0.03-2.32	0.1-4.9

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Rate, Mean for all Years	0.42	1.41	0.36	0.00	0.00	0.21	0.22	0.72	0.29
p-value for T-test, Loudon rate different		0.1961	0.8973		NA	<.0001		0.1999	0.7475
Asthma									
Hospital Outpatients (1998-2003)									
Number	1288	997	154549	638	570	87124	1926	1567	241685
Age Median (Range)	36 (0-92)	39 (0-91)	35 (0-111)	15 (0-87)	18 (0-92)	15 (0-104)	32 (0-92)	33 (0-92)	29 (0-111)
Crude Rate	1063.30	821.34	878.96	555.63	495.94	522.40	816.25	663.08	705.42
Crude Rate, 95% CI	1005.2-1121.4	770.4-872.3	874.6-883.3	512.5-598.7	455.2-536.7	518.9-525.9	779.8-852.7	630.3-695.9	702.6-708.2
Crude Rate Ratio		1.29	1.21		1.12	1.06		1.23	1.16
Crude Rate Ratio, 95% CI		1.19-1.41	1.15-1.28		1-1.25	0.98-1.15		1.15-1.32	1.11-1.21
Rate, Mean for all Years	1056.78	817.41	874.88	553.97	495.52	521.41	811.88	660.94	702.67
p-value for T-test, Loudon rate different		0.3161	0.4156		0.5428	0.7519		0.2978	0.4316
Hospital Inpatients (1997-2003)									
Number	606	588	77095	257	261	37950	863	849	115058
Age Median (Range)	52 (0-96)	59 (0-100)	51 (0-105)	48 (0-96)	53 (0-91)	39 (0-107)	51 (0-96)	57 (0-100)	48 (0-107)
Crude Rate	431.51	416.94	377.59	193.31	195.39	196.20	315.67	309.17	289.38
Crude Rate, 95% CI	397.2-465.9	383.2-450.6	374.9-380.3	169.7-216.9	171.7-219.1	194.2-198.2	294.6-336.7	288.4-330	287.7-291.1
Crude Rate Ratio		1.03	1.14		0.99	0.99		1.02	1.09
Crude Rate Ratio, 95% CI		0.92-1.16	1.06-1.24		0.83-1.18	0.87-1.11		0.93-1.12	1.02-1.17
Rate, Mean for all Years	430.78	415.72	376.55	193.12	195.20	195.82	315.19	308.47	288.62
p-value for T-test, Loudon rate different		0.7289	0.1411		0.8844	0.8461		0.8002	0.2833
Deaths (1990-2003)									
Number	5	5	887	2	2	512	7	7	1399
Age Median (Range)	75 (47-81)	66 (38-76)	68 (0-103)	66.5 (*)	64 (*)	63 (0-98)	71 (47-81)	66 (38-76)	66 (0-103)
Crude Rate	1.90	1.85	2.27	0.81	1.85	1.39	1.37	1.32	1.85
Crude Rate, 95% CI	0.6-4.4	0.6-4.3	2.1-2.4	0.1-2.9	0.1-2.8	1.3-1.5	0.6-2.8	0.5-2.7	1.7-1.9
Crude Rate Ratio		1.03	0.84		1.04	0.58		1.04	0.74
Crude Rate Ratio, 95% CI		0.3-3.56	0.35-2.02		0.15-7.41	0.14-2.33		0.36-2.95	0.35-1.56
Rate, Mean for all Years	1.93	1.84	2.28	0.91	0.74	1.41	1.44	1.30	1.86
p-value for T-test, Loudon rate different		0.9336	0.7013		0.8266	0.4426		0.8648	0.4025
Chronic Bronchitis									
Hospital Outpatients (1998-2003)									
Number	1421	653	147332	879	396	91723	2300	1049	239064

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Age Median (Range)	42 (0-102)	53 (0-95)	40 (0-106)	42 (0-98)	52 (0-93)	38 (0-110)	42 (0-102)	52 (0-95)	39 (0-110)
Crude Rate	1173.10	537.95	837.91	765.52	344.55	549.97	974.76	443.89	697.77
Crude Rate, 95% CI	1112.1-1234.1	496.7-579.2	833.6-842.2	714.9-816.1	310.6-378.5	546.4-553.5	934.9-1014.6	417-470.8	695-700.6
Crude Rate Ratio		2.18	1.40		2.22	1.39		2.20	1.40
Crude Rate Ratio, 95% CI		1.99-2.39	1.33-1.47		1.97-2.5	1.3-1.49		2.04-2.36	1.34-1.46
Rate, Mean for all Years	1168.14	535.46	834.74	764.25	344..2	549.34	971.43	442.49	695.71
p-value for T-test, Loudon rate different		0.0036	0.0827		0.0038	0.1082		0.0014	0.0538
Hospital Inpatients (1997-2003)									
Number	716	677	78370	611	562	64246	1327	1239	142641
Age Median (Range)	68 (4-98)	68 (1-101)	67 (0-108)	68 (1-96)	67 (4-96)	68 (0-105)	68 (1-98)	68 (1-101)	68 (0-108)
Crude Rate	509.84	480.05	383.83	459.58	420.73	332.15	485.40	451.20	358.75
Crude Rate, 95% CI	472.5-547.2	443.9-516.2	381.1-386.5	423.1-496	385.9-455.5	329.6-334.7	459.3-511.5	426.1-476.3	356.9-360.6
Crude Rate Ratio		1.06	1.33		1.09	1.38		1.08	1.35
Crude Rate Ratio, 95% CI		0.96-1.18	1.23-1.43		0.97-1.22	1.28-1.5		1-1.16	1.28-1.43
Rate, Mean for all Years	510.29	480.18	383.56	460.99	421.10	332.10	486.26	451.44	358.58
p-value for T-test, Loudon rate different		0.3608	0.0017		0.2406	0.0020		0.2279	0.0008
Deaths (1990-2003)									
Number	8	2	430	3	6	382	11	8	812
Age Median (Range)	80 (67-97)	76.5 (*)	78 (0-106)	82 (*)	69.5 (14-91)	74 (0-100)	80 (67-97)	69.5 (14-91)	75 (0-106)
Crude Rate	3.04	0.74	1.10	1.21	0.74	1.04	2.16	1.51	1.07
Crude Rate, 95% CI	1.3-6	0.1-2.7	1-1.2	0.3-3.5	0.9-5.1	0.9-1.1	1.1-3.9	0.6-3	1-1.1
Crude Rate Ratio		4.12	2.76		0.52	1.17		1.43	2.01
Crude Rate Ratio, 95% CI		0.87-19.4	1.37-5.56		0.13-2.09	0.37-3.63		0.57-3.54	1.11-3.65
Rate, Mean for all Years	3.07	0.73	1.12	1.35	2.35	1.07	2.23	1.52	1.10
p-value for T-test, Loudon rate different		0.0328	0.0540		0.4080	0.7171		0.3598	0.0588
Chronic Rhinitis and Sinusitis									
Hospital Outpatients (1998-2003)									
Number	1832	686	181741	1278	496	122537	3110	1182	304296
Age Median (Range)	30 (0-99)	25 (0-90)	26 (0-104)	27 (0-94)	22 (0-92)	20 (0-101)	29 (0-99)	23 (0-92)	24 (0-104)
Crude Rate	1512.40	565.13	1033.60	1113.01	431.56	734.73	1318.04	500.17	888.17
Crude Rate, 95% CI	1443.1-1581.7	522.8-607.4	1028.9-1038.4	1052-1174	393.6-469.5	730.6-738.8	1271.7-1364.4	471.7-528.7	885-891.3
Crude Rate Ratio		2.68	1.46		2.58	1.51		2.64	1.48
Crude Rate Ratio, 95% CI		2.45-2.92	1.4-1.53		2.33-2.86	1.43-1.6		2.47-2.82	1.43-1.54

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Rate, Mean for all Years	1506.39	564.28	1029.57	1112.23	431.54	733.57	1314.29	499.75	885.38
p-value for T-test, Loudon rate different		0.0011	0.0400		0.0001	0.0134		<.0001	0.0155
Hospital Inpatients (1997-2003)									
Number	259	149	29042	197	103	23402	456	252	52446
Age Median (Range)	63 (0-93)	58 (0-102)	54 (0-106)	58 (0-96)	49 (0-87)	51 (0-102)	60 (0-96)	54 (0-102)	53 (0-106)
Crude Rate	184.43	105.65	142.24	148.18	77.11	120.99	166.80	91.77	131.91
Crude Rate, 95% CI	162-206.9	88.7-122.6	140.6-143.9	127.5-168.9	62.2-92	119.4-122.5	151.5-182.1	80.4-103.1	130.8-133
Crude Rate Ratio		1.75	1.30		1.92	1.22		1.82	1.26
Crude Rate Ratio, 95% CI		1.43-2.13	1.15-1.47		1.51-2.44	1.06-1.41		1.56-2.12	1.15-1.39
Rate, Mean for all Years	183.97	105.49	141.93	148.24	77.25	120.76	166.57	91.76	131.63
p-value for T-test, Loudon rate different		0.0001	0.0091		>.0001	0.0161		>.0001	0.0020
Deaths (1990-2003)									
Number	1	0	63	0	1	68	1	1	131
Age Median (Range)	*	NA	74 (0-103)	NA	*	70.5 (0-93)	*	*	72 (0-103)
Crude Rate	0.38	0.00	0.16	0.00	0.00	0.19	0.20	0.19	0.17
Crude Rate, 95% CI	0-2.1	NA	0.1-0.2	NA	0-2.2	0.1-0.2	0-1.1	0-1.1	0.1-0.2
Crude Rate Ratio		NA	2.36		NA	NA		1.04	1.13
Crude Rate Ratio, 95% CI		NA	0.33-17		NA	NA		0.06-16.57	0.16-8.11
Rate, Mean for all Years	0.38	0.00	0.16	0.00	0.37	0.18	0.20	0.18	0.17
p-value for T-test, Loudon rate different		0.3356	0.5751		0.3265	<.0001		0.9531	0.9060
Chronis Obstructive Pulmonary Disease									
Hospital Outpatients (1998-2003)									
Number	463	438	48266	378	327	40413	841	765	88683
Age Median (Range)	66 (19-96)	63 (13-96)	64 (0-108)	66 (22-94)	63 (7-94)	65 (0-102)	66 (19-96)	63 (7-96)	65 (0-108)
Crude Rate	382.23	360.83	274.50	329.20	284.51	242.32	356.42	323.71	258.85
Crude Rate, 95% CI	347.4-417	327-394.6	272.1-276.9	296-362.4	253.7-315.4	240-244.7	332.3-380.5	300.8-346.7	257.1-260.5
Crude Rate Ratio		1.06	1.39		1.16	1.36		1.10	1.38
Crude Rate Ratio, 95% CI		0.93-1.21	1.27-1.53		1-1.34	1.23-1.5		1-1.21	1.29-1.47
Rate, Mean for all Years	378.35	358.26	272.78	327.18	283.26	241.52	353.35	321.82	257.52
p-value for T-test, Loudon rate different		0.8934	0.4112		0.6779	0.3758		0.7962	0.3644
Hospital Inpatients (1997-2003)									
Number	803	610	83435	990	695	95541	1793	1305	179005
Age Median (Range)	72 (14-100)	71 (23-100)	72 (0-108)	70 (33-99)	70 (0-95)	70 (0-107)	71 (14-100)	70 (0-100)	71 (0-108)

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Crude Rate	571.79	432.54	408.64	744.66	520.30	493.94	655.86	475.23	450.21
Crude Rate, 95% CI	532.2-611.3	398.2-466.9	405.9-411.4	698.3-791	481.6-559	490.8-497.1	625.5-686.2	449.4-501	448.1-452.3
Crude Rate Ratio		1.32	1.40		1.43	1.51		1.38	1.46
Crude Rate Ratio, 95% CI		1.19-1.47	1.31-1.5		1.3-1.58	1.42-1.6		1.29-1.48	1.39-1.53
Rate, Mean for all Years	572.19	432.06	408.05	747.15	519.56	493.53	657.16	474.63	449.69
p-value for T-test, Loudon rate different		0.0006	<.0001		0.0004	0.0005		0.0001	<.0001
Deaths (1990-2003)									
Number	90	99	12078	102	129	14979	192	228	27057
Age Median (Range)	74 (8-95)	74 (37-94)	76 (0-112)	75 (49-96)	73 (46-94)	75 (2-106)	75 (8-96)	74 (37-94)	75 (0-112)
Crude Rate	34.24	36.57	30.93	41.25	36.57	40.77	37.64	43.13	35.70
Crude Rate, 95% CI	27.5-42.1	29.7-44.5	30.4-31.5	33.2-49.2	41.4-58.6	40.1-41.4	32.3-43	37.5-48.7	35.3-36.1
Crude Rate Ratio		0.94	1.11		0.82	1.01		0.87	1.05
Crude Rate Ratio, 95% CI		0.7-1.25	0.9-1.36		0.64-1.07	0.83-1.23		0.72-1.06	0.91-1.21
Rate, Mean for all Years	33.56	36.26	30.56	41.32	49.82	40.56	37.30	42.88	35.40
p-value for T-test, Loudon rate different		0.6473	0.4811		0.1721	0.8197		0.2661	0.5311
Emphysema									
Hospital Outpatients (1998-2003)									
Number	64	67	7916	66	72	7443	130	139	15360
Age Median (Range)	64 (33-89)	63 (26-86)	62 (0-100)	64 (39-87)	66 (28-89)	64 (8-99)	64 (33-89)	65 (26-89)	63 (0-100)
Crude Rate	52.83	55.20	45.02	57.48	62.65	44.63	55.10	58.82	44.83
Crude Rate, 95% CI	40.7-67.5	42.8-70.1	44-46	44.5-73.1	49-78.9	43.6-45.6	45.6-64.6	49-68.6	44.1-45.5
Crude Rate Ratio		0.96	1.17		0.92	1.29		0.94	1.23
Crude Rate Ratio, 95% CI		0.68-1.35	0.92-1.5		0.66-1.28	1.01-1.64		0.74-1.19	1.03-1.46
Rate, Mean for all Years	52.21	54.75	44.74	57.14	62.43	44.48	54.59	58.49	44.61
p-value for T-test, Loudon rate different		0.9209	0.7266		0.8197	0.4901		0.8632	0.5940
Hospital Inpatients (1997-2003)									
Number	63	61	8121	107	99	11952	170	160	20074
Age Median (Range)	63 (29-90)	67 (34-90)	69 (0-105)	69 (32-95)	67 (26-89)	67 (0-102)	67 (29-95)	67 (26-90)	68 (0-105)
Crude Rate	44.86	43.25	39.77	80.48	74.11	61.79	62.18	58.27	50.49
Crude Rate, 95% CI	34.5-57.4	33.1-55.6	38.9-40.6	65.2-95.7	60.2-90.2	60.7-62.9	52.8-71.5	49.2-67.3	49.8-51.2
Crude Rate Ratio		1.04	1.13		1.09	1.30		1.07	1.23
Crude Rate Ratio, 95% CI		0.73-1.47	0.88-1.45		0.83-1.43	1.08-1.58		0.86-1.32	1.06-1.43
Rate, Mean for all Years	44.71	43.23	39.73	80.32	74.01	61.79	62.02	58.20	50.46

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
p-value for T-test, Loudon rate different		0.8303	0.3330		0.5426	0.0384		0.5551	0.0530
Deaths (1990-2003)									
Number	19	17	2046	20	24	2986	39	41	5032
Age Median (Range)	70 (46-87)	70 (60-88)	72 (31-102)	70.5 (49-89)	69 (53-87)	73 (24-98)	70 (46-89)	70 (53-88)	73 (24-102)
Crude Rate	7.23	6.28	5.24	8.09	6.28	8.13	7.65	7.76	6.64
Crude Rate, 95% CI	4.4-11.3	3.7-10.1	5-5.5	4.9-12.5	6-13.8	7.8-8.4	5.4-10.5	5.6-10.5	6.5-6.8
Crude Rate Ratio		1.15	1.38		0.87	1.00		0.99	1.15
Crude Rate Ratio, 95% CI		0.6-2.21	0.88-2.17		0.48-1.57	0.64-1.54		0.64-1.53	0.84-1.58
Rate, Mean for all Years	7.04	6.25	5.21	8.24	9.16	8.13	7.61	7.67	6.62
p-value for T-test, Loudon rate different		0.7617	0.3822		0.6687	0.9447		0.9703	0.4114
Pneumoconioses due to External Agents									
Hospital Outpatients (1998-2003)									
Number	15	11	976	23	10	1433	38	21	2409
Age Median (Range)	38 (8-78)	39 (18-74)	42 (0-96)	59 (19-87)	47 (30-75)	57 (0-120)	48 (8-87)	46 (18-75)	50 (0-120)
Crude Rate	12.38	9.06	5.55	20.03	8.70	8.59	16.10	8.89	7.03
Crude Rate, 95% CI	6.9-20.4	4.5-16.2	5.2-5.9	12.7-30.1	4.2-16	8.1-9	11.4-22.1	5.5-13.6	6.8-7.3
Crude Rate Ratio		1.37	2.23		2.30	2.33		1.81	2.29
Crude Rate Ratio, 95% CI		0.63-2.97	1.34-3.71		1.1-4.84	1.54-3.52		1.06-3.09	1.66-3.16
Rate, Mean for all Years	12.44	8.96	5.54	20.00	8.67	8.59	16.12	8.82	7.02
p-value for T-test, Loudon rate different		0.5368	0.0424		0.0498	0.0268		0.1011	0.0004
Hospital Inpatients (1997-2003)									
Number	12	3	864	65	15	4122	77	18	4986
Age Median (Range)	66 (1-85)	74 (*)	65 (0-96)	75 (28-88)	72 (50-86)	73 (0-106)	74 (1-88)	73 (50-89)	72 (0-106)
Crude Rate	8.54	2.13	4.23	48.89	11.23	21.31	28.17	6.55	12.54
Crude Rate, 95% CI	4.4-14.9	0.4-6.2	3.9-4.5	37.7-62.3	6.3-18.5	20.7-22	22.2-35.2	3.9-10.4	12.2-12.9
Crude Rate Ratio		4.02	2.02		4.35	2.29		4.30	2.25
Crude Rate Ratio, 95% CI		1.13-14.23	1.14-3.57		2.48-7.63	1.8-2.93		2.57-7.18	1.79-2.81
Rate, Mean for all Years	8.54	2.10	4.22	48.93	11.21	21.34	28.19	6.53	12.55
p-value for T-test, Loudon rate different		0.0905	0.2247		>.0001	0.0002		>.0001	0.0002
Deaths (1990-2003)									
Number	1	0	10	1	0	247	2	0	257
Age Median (Range)	*	NA	75 (37-89)	*	NA	78 (2-99)	77 (*)	NA	61 (10-94)
Crude Rate	0.38	0.00	0.03	0.40	0.00	0.67	0.39	0.00	0.34

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Crude Rate, 95% CI	0-2.1	NA	0.01-0.05	0-2.3	NA	0.6-0.8	0-1.4	NA	0.3-0.4
Crude Rate Ratio		NA	14.86		NA	0.60		NA	1.16
Crude Rate Ratio, 95% CI		NA	1.9-116.05		NA	0.08-4.29		NA	0.29-4.65
Rate, Mean for all Years	0.36	0.00	0.03	0.37	0.00	0.67	0.37	0.00	0.34
p-value for T-test, Loudon rate different		0.3265	0.3703		0.3356	0.4374		0.1649	0.9057
Pleurisy									
Hospital Outpatients (1998-2003)									
Number	196	183	22012	128	113	13143	324	296	35158
Age Median (Range)	52 (12-91)	45 (14-92)	43 (0-107)	56 (8-88)	43 (12-96)	45 (0-100)	54 (8-91)	44 (12-96)	44 (0-107)
Crude Rate	161.81	150.76	125.19	111.47	98.32	78.81	137.31	125.25	102.62
Crude Rate, 95% CI	139.2-184.5	128.9-172.6	123.5-126.8	92.2-130.8	80.2-116.4	77.5-80.2	122.4-152.3	111-139.5	101.5-103.7
Crude Rate Ratio		1.07	1.29		1.13	1.41		1.10	1.34
Crude Rate Ratio, 95% CI		0.88-1.31	1.12-1.49		0.88-1.46	1.19-1.68		0.94-1.28	1.2-1.49
Rate, Mean for all Years	160.48	150.40	124.64	111.27	98.41	78.69	136.48	125.12	102.26
p-value for T-test, Loudon rate different		0.8288	0.4057		0.5044	0.0407		0.6844	0.1946
Hospital Inpatients (1997-2003)									
Number	269	219	29934	199	175	24435	468	394	54373
Age Median (Range)	74 (0-96)	72 (0-97)	72 (0-111)	69 (16-96)	66 (1-91)	67 (0-104)	72 (0-96)	68 (0-97)	70 (0-111)
Crude Rate	191.55	155.29	146.61	149.68	131.01	126.33	171.19	143.48	136.75
Crude Rate, 95% CI	168.7-214.4	134.7-175.9	144.9-148.3	128.9-170.5	111.6-150.4	124.7-127.9	155.7-186.7	129.3-157.6	135.6-137.9
Crude Rate Ratio		1.23	1.31		1.14	1.18		1.19	1.25
Crude Rate Ratio, 95% CI		1.03-1.47	1.16-1.47		0.93-1.4	1.03-1.36		1.04-1.36	1.14-1.37
Rate, Mean for all Years	191.29	155.18	146.51	149.44	131.09	126.24	170.92	143.46	136.66
p-value for T-test, Loudon rate different		0.1215	0.0542		0.1770	0.0979		0.0690	0.0315
Deaths (1990-2003)									
Number	1	2	138	0	0	93	1	2	231
Age Median (Range)	*	87.5 (*)	81 (1-102)	NA	NA	80 (26-100)	*	87.5 (*)	81 (1-102)
Crude Rate	0.38	0.74	0.35	0.00	0.74	0.25	0.20	0.38	0.30
Crude Rate, 95% CI	0-2.1	0.1-2.7	0.3-0.4	NA	NA	0.2-0.3	0-1.1	0-1.4	0.3-0.3
Crude Rate Ratio		0.51	1.08		NA	NA		0.52	0.64
Crude Rate Ratio, 95% CI		0.05-5.68	0.15-7.7		NA	NA		0.05-5.71	0.09-4.58
Rate, Mean for all Years	0.40	0.75	0.35	0.00	0.00	0.25	0.21	0.38	0.30
p-value for T-test, Loudon rate different		0.5936	0.9034		NA	<.0001		0.5998	0.6547

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Pneumonia									
Hospital Outpatients (1998-2003)									
Number	535	401	67592	467	405	60624	1002	806	128225
Age Median (Range)	41 (0-96)	38 (0-102)	20 (11-29)	36 (0-94)	34 (0-93)	27 (0-103)	38 (0-96)	36 (0-102)	31 (0-108)
Crude Rate	441.67	330.35	384.41	406.71	352.38	363.50	424.66	341.06	374.26
Crude Rate, 95% CI	404.2-479.1	298-362.7	381.5-387.3	369.8-443.6	318.1-386.7	360.6-366.4	398.4-450.9	317.5-364.6	372.2-376.3
Crude Rate Ratio		1.34	1.15		1.15	1.12		1.25	1.13
Crude Rate Ratio, 95% CI		1.17-1.52	1.06-1.25		1.01-1.32	1.02-1.23		1.14-1.37	1.07-1.21
Rate, Mean for all Years	439.71	329.54	383.70	407.24	352.00	363.81	423.79	340.48	374.00
p-value for T-test, Loudon rate different		0.1152	0.3647		0.3763	0.3966		0.0923	0.1630
Hospital Inpatients (1997-2003)									
Number	1301	1318	168617	1166	1142	146383	2467	2460	315038
Age Median (Range)	70 (0-102)	72 (0-102)	70 (0-109)	69 (0-100)	66 (0-96)	66 (0-109)	69 (0-102)	69 (0-102)	68 (0-109)
Crude Rate	926.40	934.58	825.84	877.04	854.94	756.79	902.40	895.84	792.34
Crude Rate, 95% CI	876.1-976.7	884.1-985	821.9-829.8	826.7-927.4	805.4-904.5	752.9-760.7	866.8-938	860.4-931.2	789.6-795.1
Crude Rate Ratio		0.99	1.12		1.03	1.16		1.01	1.14
Crude Rate Ratio, 95% CI		0.92-1.07	1.06-1.18		0.95-1.11	1.09-1.23		0.95-1.06	1.09-1.18
Rate, Mean for all Years	925.72	932.94	825.31	877.36	853.80	756.57	902.19	894.46	791.95
p-value for T-test, Loudon rate different		0.9092	0.0261		0.5970	0.0001		0.8729	0.0006
Deaths (1990-2003)									
Number	97	108	13856	87	66	11145	184	174	25001
Age Median (Range)	85 (52-103)	85 (0-102)	85 (0-113)	80 (44-96)	79.5 (46-101)	80 (0-110)	82 (44-103)	84 (0-102)	83 (0-113)
Crude Rate	36.91	39.90	35.49	35.18	39.90	30.34	36.07	32.91	32.99
Crude Rate, 95% CI	29.9-45	32.4-47.4	34.9-36.1	28.2-43.4	19.8-32.5	29.8-30.9	30.9-41.3	28-37.8	32.6-33.4
Crude Rate Ratio		0.93	1.04		1.38	1.16		1.10	1.09
Crude Rate Ratio, 95% CI		0.7-1.22	0.85-1.27		1-1.89	0.94-1.43		0.89-1.35	0.95-1.26
Rate, Mean for all Years	36.85	39.82	35.53	35.07	37.66	30.52	35.99	33.03	33.10
p-value for T-test, Loudon rate different		0.6081	0.7022		0.1218	0.3696		0.5107	0.4022
Other Respiratory Diseases									
Hospital Outpatients (1998-2003)									
Number	382	278	50380	306	229	40145	688	507	90528
Age Median (Range)	53 (0-97)	48 (0-102)	40 (0-104)	50 (0-90)	50 (0-94)	33 (0-101)	52 (0-97)	49 (0-102)	38 (0-104)
Crude Rate	315.36	229.02	286.52	266.49	199.25	240.71	291.58	214.54	264.23

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Crude Rate, 95% CI	283.7-347	202.1-255.9	284-289	236.6-296.4	173.4-225.1	238.4-243.1	269.8-313.4	195.9-233.2	262.5-266
Crude Rate Ratio		1.38	1.10		1.34	1.11		1.36	1.10
Crude Rate Ratio, 95% CI		1.18-1.61	1-1.22		1.13-1.59	0.99-1.24		1.21-1.52	1.02-1.19
Rate, Mean for all Years	312.57	227.92	285.45	264.84	198.58	240.35	289.29	213.66	263.47
p-value for T-test, Loudon rate different		0.3404	0.7435		0.3330	0.6566		0.3021	0.6850
Hospital Inpatients (1997-2003)									
Number	1018	642	101750	930	646	94091	1948	1288	195867
Age Median (Range)	69 (0-104)	67 (0-102)	68 (0-108)	67 (0-96)	66 (0-95)	65 (0-103)	68 (0-104)	66 (0-102)	67 (0-108)
Crude Rate	724.89	455.24	498.34	699.53	483.62	486.45	712.55	469.04	492.62
Crude Rate, 95% CI	680.4-769.4	420-490.4	495.3-501.4	654.6-744.5	446.3-520.9	483.3-489.6	680.9-744.2	443.4-494.7	490.4-494.8
Crude Rate Ratio		1.59	1.45		1.45	1.44		1.52	1.45
Crude Rate Ratio, 95% CI		1.44-1.76	1.37-1.55		1.31-1.6	1.35-1.53		1.42-1.63	1.38-1.51
Rate, Mean for all Years	724.96	454.65	497.93	700.67	483.48	486.25	713.04	468.68	492.30
p-value for T-test, Loudon rate different		>.0001	>.0001		0.0001	0.0002		>.0001	>.0001
Deaths (1990-2003)									
Number	18	22	2369	18	23	2414	36	45	4783
Age Median (Range)	74 (41-93)	77 (17-84)	76 (0-103)	77 (15-91)	74 (44-95)	73 (0-103)	77 (15-93)	75 (17-95)	75 (0-103)
Crude Rate	6.85	8.13	6.07	7.28	8.13	6.57	7.06	8.51	6.31
Crude Rate, 95% CI	4.1-10.8	5.1-12.3	5.8-6.3	4.3-11.5	5.7-13.4	6.3-6.8	4.9-9.8	6.2-11.4	6.1-6.5
Crude Rate Ratio		0.84	1.13		0.82	1.11		0.83	1.12
Crude Rate Ratio, 95% CI		0.45-1.57	0.71-1.79		0.44-1.51	0.7-1.76		0.53-1.29	0.81-1.55
Rate, Mean for all Years	6.73	8.18	6.00	7.40	25.87	6.51	7.05	8.48	6.25
p-value for T-test, Loudon rate different		0.5694	0.7327		0.5368	0.6569		0.4495	0.6600
OTHER ILLNESSES									
Aplastic Anemia									
Hospital Outpatients (1998-2003)									
Number	15	6	1405	6	10	1199	21	16	2604
Age Median (Range)	55 (0-85)	68 (48-80)	57 (0-101)	60 (3-87)	46 (13-74)	54 (0-100)	55 (0-87)	58 (13-80)	56 (0-101)
Crude Rate	12.38	4.94	7.99	5.23	8.70	7.19	8.90	6.77	7.60
Crude Rate, 95% CI	6.9-20.4	1.8-10.8	7.6-8.4	1.9-11.4	4.2-16	6.8-7.6	5.5-13.6	3.9-11	7.3-7.9
Crude Rate Ratio		2.51	1.55		0.60	0.73		1.31	1.17
Crude Rate Ratio, 95% CI		0.97-6.46	0.93-2.58		0.22-1.65	0.33-1.62		0.69-2.52	0.76-1.8
Rate, Mean for all Years	12.31	4.92	7.96	5.23	8.67	7.17	8.86	6.74	7.57

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
p-value for T-test, Loudon rate different		0.0634	0.2116		0.3028	0.3821		0.3328	0.5128
Hospital Inpatients (1997-2003)									
Number	93	63	9406	78	77	9607	171	140	19015
Age Median (Range)	70 (0-93)	70 (14-94)	64 (0-104)	62 (3-87)	63 (1-88)	61 (0-103)	65 (0-93)	68 (1-94)	62 (0-104)
Crude Rate	66.22	44.67	46.07	58.67	57.64	49.67	62.55	50.98	47.82
Crude Rate, 95% CI	53.5-81.1	34.3-57.2	45.1-47	46.4-73.2	45.5-72	48.7-50.7	53.2-71.9	42.5-59.4	47.1-48.5
Crude Rate Ratio		1.48	1.44		1.02	1.18		1.23	1.31
Crude Rate Ratio, 95% CI		1.08-2.04	1.17-1.76		0.74-1.39	0.95-1.48		0.98-1.53	1.13-1.52
Rate, Mean for all Years	66.09	44.68	46.05	58.79	57.59	49.60	62.54	50.96	47.78
p-value for T-test, Loudon rate different		0.0640	0.0634		0.8853	0.2308		0.1097	0.0342
Deaths (1990-2003)									
Number	0	2	186	2	4	161	2	6	347
Age Median (Range)	NA	80 (*)	81 (3-106)	78 (*)	78 (55-80)	78 (10-99)	78 (*)	78 (55-90)	80 (3-106)
Crude Rate	0.00	0.74	0.48	0.81	0.74	0.44	0.39	1.13	0.46
Crude Rate, 95% CI	NA	0.1-2.7	0.4-0.5	0.1-2.9	0.4-4	0.4-0.5	0-1.4	0.4-2.5	0.4-0.5
Crude Rate Ratio		NA	NA		0.52	1.85		0.35	0.86
Crude Rate Ratio, 95% CI		NA	NA		0.1-2.85	0.46-7.44		0.07-1.71	0.21-3.44
Rate, Mean for all Years	0.00	0.71	0.48	0.90	1.51	0.44	0.43	1.10	0.46
p-value for T-test, Loudon rate different		0.1648	<.0001		0.5896	0.6185		0.2434	0.9559
Heart, Ischemic Diseases									
Hospital Outpatients (1998-2003)									
Number	1570	1094	125566	1823	1383	147574	3393	2477	273153
Age Median (Range)	67 (8-100)	66 (22-102)	67 (0-107)	63 (16-93)	61 (20-94)	62 (0-107)	65 (8-100)	63 (20-102)	64 (0-107)
Crude Rate	1296.11	901.25	714.12	1587.65	1203.31	884.85	1437.98	1048.16	797.27
Crude Rate, 95% CI	1232-1360.2	847.8-954.7	710.2-718.1	1514.8-1660.5	1139.9-1266.7	880.3-889.4	1389.6-1486.4	1006.9-1089.4	794.3-800.3
Crude Rate Ratio		1.44	1.81		1.32	1.79		1.37	1.80
Crude Rate Ratio, 95% CI		1.33-1.55	1.73-1.91		1.23-1.41	1.71-1.88		1.3-1.44	1.74-1.87
Rate, Mean for all Years	1289.24	898.45	711.17	1583.08	1200.67	883.14	1432.16	1045.46	794.85
p-value for T-test, Loudon rate different		0.0846	0.0141		0.1815	0.0127		0.0829	0.0058
Hospital Inpatients (1997-2003)									
Number	2519	2407	266092	3162	2686	318359	5681	5094	584571
Age Median (Range)	74 (29-104)	73 (28-102)	73 (0-113)	67 (5-96)	68 (21-100)	67 (0-108)	70 (5-104)	70 (21-102)	70 (0-113)
Crude Rate	1793.70	1706.78	1303.24	2378.39	2010.83	1645.90	2078.04	1855.04	1470.24

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Crude Rate, 95% CI	1723.7-1863.7	1638.6-1775	1298.3-1308.2	2295.5-2461.3	1934.8-2086.9	1640.2-1651.6	2024-2132.1	1804.1-1906	1466.5-1474
Crude Rate Ratio		1.05	1.38		1.18	1.45		1.12	1.41
Crude Rate Ratio, 95% CI		0.99-1.11	1.32-1.43		1.12-1.24	1.4-1.5		1.08-1.16	1.38-1.45
Rate, Mean for all Years	1793.26	1706.44	1302.35	2378.65	2009.10	1644.73	2077.92	1854.02	1469.21
p-value for T-test, Loudon rate different		0.1435	<.0001		0.0016	<.0001		0.0017	<.0001
Deaths (1990-2003)									
Number	654	609	75763	748	715	80699	1402	1324	156462
Age Median (Range)	82 (21-103)	83 (8-103)	82 (0-115)	72 (20-100)	73 (18-102)	73 (0-115)	77 (20-103)	78 (8-103)	78 (0-115)
Crude Rate	248.84	224.98	194.04	302.47	224.98	219.65	274.84	250.44	206.46
Crude Rate, 95% CI	229.8-267.9	207.1-242.9	192.7-195.4	280.8-324.1	256.8-297.5	218.1-221.2	260.5-289.2	237-263.9	205.4-207.5
Crude Rate Ratio		1.11	1.28		1.09	1.38		1.10	1.33
Crude Rate Ratio, 95% CI		0.99-1.23	1.19-1.38		0.99-1.21	1.28-1.48		1.02-1.18	1.26-1.4
Rate, Mean for all Years	248.17	224.87	193.89	303.65	278.29	220.02	275.03	251.00	206.54
p-value for T-test, Loudon rate different		0.0701	<.0001		0.2057	<.0001		0.0413	<.0001
Hypertension, Primary									
Hospital Outpatients (1998-2003)									
Number	4516	4751	485312	2831	2931	284180	7347	7683	769520
Age Median (Range)	63 (9-101)	64 (9-104)	61 (0-111)	59 (5-94)	59 (4-94)	58 (0-105)	61 (5-101)	62 (4-104)	60 (0-111)
Crude Rate	3728.16	3913.93	2760.09	2465.51	2550.18	1703.94	3113.72	3251.10	2246.05
Crude Rate, 95% CI	3619.4-3836.9	3802.6-4025.2	2752.3-2767.9	2374.7-2556.3	2457.9-2642.5	1697.7-1710.2	3042.5-3184.9	3178.4-3323.8	2241-2251.1
Crude Rate Ratio		0.95	1.35		0.97	1.45		0.96	1.39
Crude Rate Ratio, 95% CI		0.92-0.99	1.31-1.39		0.92-1.02	1.39-1.5		0.93-0.99	1.36-1.42
Rate, Mean for all Years	3692.72	3885.03	2741.82	2445.51	2536.89	1695.25	3085.01	3230.12	2231.90
p-value for T-test, Loudon rate different		0.8944	0.4025		0.9159	0.2484		0.8960	0.3137
Hospital Inpatients (1997-2003)									
Number	4449	4705	518834	3329	3343	370892	7778	8050	889846
Age Median (Range)	72 (0-102)	72 (20-103)	71 (0-111)	66 (1-97)	66 (16-95)	65 (0-107)	69 (0-102)	69 (16-103)	69 (0-111)
Crude Rate	3167.99	3336.26	2541.09	2504.01	2502.68	1917.50	2845.09	2931.50	2238.03
Crude Rate, 95% CI	3074.9-3261.1	3240.9-3431.6	2534.2-2548	2418.9-2589.1	2417.8-2587.5	1911.3-1923.7	2781.9-2908.3	2867.5-2995.5	2233.4-2242.7
Crude Rate Ratio		0.95	1.25		1.00	1.31		0.97	1.27
Crude Rate Ratio, 95% CI		0.91-0.99	1.21-1.28		0.95-1.05	1.26-1.35		0.94-1	1.24-1.3
Rate, Mean for all Years	3160.49	3331.50	2535.70	2497.21	2499.62	1912.53	2837.90	2927.60	2232.77
p-value for T-test, Loudon rate different		0.4344	0.0099		0.9868	0.0013		0.6107	0.0036

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Deaths (1990-2003)									
Number	13	24	2687	11	7	1723	24	31	4410
Age Median (Range)	88 (63-94)	84 (52-96)	82 (0-113)	75 (42-90)	72 (46-94)	76 (4-102)	82 (42-94)	82 (46-96)	80 (0-113)
Crude Rate	4.95	8.87	6.88	4.45	8.87	4.69	4.70	5.86	5.82
Crude Rate, 95% CI	2.6-8.5	5.7-13.2	6.6-7.1	2.2-8	1.1-5.6	4.5-4.9	3-7	4-8.3	5.6-6
Crude Rate Ratio		0.56	0.72		1.64	0.95		0.80	0.81
Crude Rate Ratio, 95% CI		0.28-1.1	0.42-1.24		0.64-4.23	0.52-1.72		0.47-1.37	0.54-1.21
Rate, Mean for all Years	4.68	8.67	6.75	4.05	2.74	4.60	4.38	5.79	5.71
p-value for T-test, Loudon rate different		0.1379	0.3158		0.5514	0.7702		0.4741	0.4560
Hypertension, Secondary									
Hospital Outpatients (1998-2003)									
Number	86	35	7720	48	20	5091	134	55	12813
Age Median (Range)	68 (42-95)	66 (44-87)	67 (9-103)	69 (20-87)	67 (42-87)	62 (1-97)	68 (20-95)	66 (42-87)	64 (1-103)
Crude Rate	71.00	28.83	43.91	41.80	17.40	30.53	56.79	23.27	37.40
Crude Rate, 95% CI	56.8-87.7	20.1-40.1	42.9-44.9	30.8-55.4	10.6-26.9	29.7-31.4	47.2-66.4	17.5-30.3	36.8-38
Crude Rate Ratio		2.46	1.62		2.40	1.37		2.44	1.52
Crude Rate Ratio, 95% CI		1.66-3.65	1.31-2		1.43-4.05	1.03-1.82		1.78-3.34	1.28-1.8
Rate, Mean for all Years	70.31	28.74	43.74	41.59	17.35	30.49	56.32	23.20	37.29
p-value for T-test, Loudon rate different		0.0704	0.2088		0.0230	0.2389		0.0333	0.1653
Hospital Inpatients (1997-2003)									
Number	288	270	47094	198	172	29691	486	442	76821
Age Median (Range)	75 (26-100)	73 (31-97)	75 (0-107)	71 (31-97)	69 (30-94)	69 (0-106)	73 (26-100)	71 (30-97)	73 (0-107)
Crude Rate	205.08	191.45	230.65	148.93	128.76	153.50	177.77	160.96	193.21
Crude Rate, 95% CI	181.4-228.8	168.6-214.3	228.6-232.7	128.2-169.7	109.5-148	151.8-155.2	162-193.6	146-176	191.8-194.6
Crude Rate Ratio		1.07	0.89		1.16	0.97		1.10	0.92
Crude Rate Ratio, 95% CI		0.91-1.26	0.79-1		0.94-1.42	0.84-1.12		0.97-1.26	0.84-1.01
Rate, Mean for all Years	205.24	192.43	230.93	148.36	129.54	153.76	177.65	161.84	193.49
p-value for T-test, Loudon rate different		0.7131	0.2508		0.5928	0.7592		0.6104	0.2761
Deaths (1990-2003)									
Number	22	38	6911	15	17	4317	37	55	11228
Age Median (Range)	80.5 (63-97)	86.5 (60-99)	82 (12-106)	75 (21-93)	80 (37-89)	70 (10-104)	80 (21-97)	84 (37-99)	78 (10-106)
Crude Rate	8.37	14.04	17.70	6.07	14.04	11.75	7.25	10.40	14.82
Crude Rate, 95% CI	5.2-12.7	9.9-19.3	17.3-18.1	3.4-10	3.8-10.6	11.4-12.1	5.1-10	7.8-13.5	14.5-15.1

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Crude Rate Ratio		0.60	0.47		0.92	0.52		0.70	0.49
Crude Rate Ratio, 95% CI		0.35-1.01	0.31-0.72		0.46-1.84	0.31-0.86		0.46-1.06	0.35-0.68
Rate, Mean for all Years	8.57	14.11	17.61	6.05	6.60	11.65	7.35	10.44	14.72
p-value for T-test, Loudon rate different		0.0948	0.0003		0.7967	0.0014		0.1349	<.0001
Other Heart Diseases									
Hospital Outpatients (1998-2003)									
Number	1641	1135	167075	1208	813	116222	2849	1949	283313
Age Median (Range)	69 (0-101)	67 (0-104)	67 (0-113)	67 (0-96)	65 (4-98)	64 (0-110)	68 (0-101)	66 (0-104)	66 (0-113)
Crude Rate	1354.72	935.03	950.20	1052.04	707.37	696.87	1207.43	824.73	826.93
Crude Rate, 95% CI	1289.2-1420.3	880.6-989.4	945.6-954.8	992.7-1111.4	658.7-756	692.9-700.9	1163.1-1251.8	788.1-861.3	823.9-830
Crude Rate Ratio		1.45	1.43		1.49	1.51		1.46	1.46
Crude Rate Ratio, 95% CI		1.34-1.56	1.36-1.5		1.36-1.62	1.43-1.6		1.38-1.55	1.41-1.51
Rate, Mean for all Years	1346.32	930.85	946.51	1049.08	706.01	695.80	1201.47	821.99	883.14
p-value for T-test, Loudon rate different		0.1566	0.1389		0.0882	0.0718		0.0765	0.0637
Hospital Inpatients (1997-2003)									
Number	3215	2736	344496	2695	2207	282446	5910	4944	627031
Age Median (Range)	76 (0-104)	76 (0-102)	75 (0-113)	71 (0-99)	71 (1-100)	70 (0-112)	73 (0-104)	74 (0-102)	73 (0-113)
Crude Rate	2289.30	1940.07	1687.24	2027.12	1652.23	1460.23	2161.80	1800.42	1577.03
Crude Rate, 95% CI	2210.2-2368.4	1867.4-2012.8	1681.6-1692.9	1950.6-2103.7	1583.3-1721.2	1454.8-1465.6	2106.7-2216.9	1750.2-1850.6	1573.1-1580.9
Crude Rate Ratio		1.18	1.36		1.23	1.39		1.20	1.37
Crude Rate Ratio, 95% CI		1.12-1.24	1.31-1.4		1.16-1.3	1.34-1.44		1.16-1.25	1.34-1.41
Rate, Mean for all Years	2291.08	1940.00	1686.46	2029.42	1651.40	1460.03	2163.81	1799.98	1576.50
p-value for T-test, Loudon rate different		0.0001	<.0001		0.0001	<.0001		<.0001	<.0001
Deaths (1990-2003)									
Number	222	149	29014	148	169	24859	370	318	53873
Age Median (Range)	82.5 (36-104)	80 (1-101)	82 (0-115)	76.5 (23-96)	73 (34-100)	73 (0-108)	81 (23-104)	77 (1-101)	78 (0-115)
Crude Rate	84.47	55.04	74.31	59.85	55.04	67.66	72.53	60.15	71.09
Crude Rate, 95% CI	73.4-95.6	46.2-63.9	73.5-75.2	50.2-69.5	55.6-75.4	66.8-68.5	65.1-79.9	53.5-66.8	70.5-71.7
Crude Rate Ratio		1.53	1.14		0.91	0.88		1.21	1.02
Crude Rate Ratio, 95% CI		1.25-1.89	1-1.3		0.73-1.14	0.75-1.04		1.04-1.4	0.92-1.13
Rate, Mean for all Years	85.78	54.98	74.83	60.79	65.57	68.48	73.68	60.16	71.74
p-value for T-test, Loudon rate different		0.0112	0.2037		0.5537	0.3032		0.1146	0.7795
Myasthenia Gravis									

Disease	FEMALES			MALES			TOTAL		
	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee	Loudon	Franklin	Tennessee
Hospital Outpatients (1998-2003)									
Number	8	4	516	6	0	295	14	4	811
Age Median (Range)	48 (39-61)	45 (41-64)	50 (3-93)	59 (36-70)	NA	67 (3-95)	49 (36-70)	45 (41-64)	56 (3-95)
Crude Rate	6.60	3.30	2.93	5.23	0.00	1.77	5.93	1.69	2.37
Crude Rate, 95% CI	2.8-13	0.9-8.4	2.7-3.2	1.9-11.4	NA	1.6-2	3.2-10	0.5-4.3	2.2-2.5
Crude Rate Ratio		2.00	2.25		NA	2.95		3.51	2.51
Crude Rate Ratio, 95% CI		0.6-6.66	1.12-4.52		NA	1.32-6.63		1.15-10.65	1.48-4.25
Rate, Mean for all Years	6.57	3.30	2.92	5.26	0.00	1.77	5.92	1.69	2.36
p-value for T-test, Loudon rate different		0.1210	0.0754		0.0415	0.1307		0.0190	0.0534
Hospital Inpatients (1997-2003)									
Number	4	9	1033	13	2	928	17	11	1962
Age Median (Range)	55 (45-63)	83 (19-91)	63 (4-96)	61 (36-85)	63 (*)	71 (0-99)	61 (36-85)	82 (19-91)	68 (0-99)
Crude Rate	2.85	6.38	5.06	9.78	1.50	4.80	6.22	4.01	4.93
Crude Rate, 95% CI	0.8-7.3	2.9-12.1	4.8-5.4	5.2-16.7	0.2-5.4	4.5-5.1	3.6-10	2-7.2	4.7-5.2
Crude Rate Ratio		1.35	0.56		6.53	2.04		1.47	1.26
Crude Rate Ratio, 95% CI		1.08-1.69	0.21-1.5		1.47-28.94	1.18-3.52		1.2-1.81	0.78-2.03
Rate, Mean for all Years	2.81	6.30	5.05	9.86	1.50	4.79	6.24	3.97	4.93
p-value for T-test, Loudon rate different		0.2369	0.0670		0.0018	0.0344		0.2001	0.0591
Deaths (1990-2003)									
Number	0	0	75	1	0	69	1	0	144
Age Median (Range)	NA	NA	78 (13-91)	*	NA	77(30-95)	*	NA	77(13-95)
Crude Rate	0.00	0.00	0.19	0.40	0.00	0.19	0.20	0.00	0.19
Crude Rate, 95% CI	NA	NA	0.15-0.24	0.01-1.2	NA	0.15-0.24	0.005-0.6	NA	0.15-0.24
Crude Rate Ratio		NA	NA		NA	2.15		NA	1.03
Crude Rate Ratio, 95% CI		NA	NA		NA	0.3-15.5		NA	0.14-7.37
Rate, Mean for all Years	0.00	0.00	0.19	0.39	0.00	0.18	0.19	0.00	0.19
p-value for T-test, Loudon rate different		NA	<.0001		0.3356	0.6092		0.3356	0.9966

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Appendix F

Discussion of

Individual Cancers and Other Diseases

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Bronchus and Lung Cancer

Using data from the TCR, bronchus and lung cancer rates were statistically higher for Loudon County females, males, and both sexes combined when compared to Franklin County and Tennessee rates. In addition, females had statistically higher rates than Tennessee when using hospital in-patient data and males had a statistically higher rate than Tennessee when comparing hospital in-patient and out-patient data and from mortality data. Males in Loudon County also had a higher rate than Franklin County using in-patient hospital data. Comparison of hospital in-patient data showed an increased rate for Loudon County compared to Franklin County for both sexes combined.

For bronchus and lung cancer, Loudon County ranked number 9th in the state for females, 17th males, and 9th both sexes combined using data from the TCR. The numbers of bronchus and lung cancers are large enough to provide stable rates, with little variance.

Leukemia

Rates of leukemia in Loudon County are generally unremarkable when compared to rates in Franklin County and Tennessee, except for myeloid leukemia, either chronic or unspecified. For both sexes combined, the rate in Loudon County is significantly lower than the rate in Franklin County for in-patient data and deaths and lower than the rate in Tennessee for in-patient and outpatient hospital data and for deaths. For females the rate in Loudon County is significantly lower than Franklin County rate for in-patient hospital data and for deaths and is significantly lower than the Tennessee rate for all four databases. For males, the rate in Loudon County is significantly lower than the rate in Franklin County for in-patient hospital data and is significantly lower than the rate in Tennessee for in-patient and out-patient hospital data. There are too few cases in the TCR for statistical analysis.

Acute myeloid leukemia, associated with benzene exposure, is not significantly different from Franklin County or Tennessee for females, males, or both sexes combined for any databases.

Nasopharyngeal Cancer

Formaldehyde has been shown to have some relationship to nasopharyngeal cancer, but this relationship is currently uncertain and under investigation by the U.S. EPA and the National Cancer Institute. The rate of nasopharyngeal cancer is of interest in Loudon because of the uncertainty related to both air concentrations of and toxicity information about formaldehyde.

The numbers of cases in Loudon and Franklin Counties are extremely low, making valid statistical comparisons impossible.

Liver Cancer

The liver is the site of toxic effects for many chemicals. Liver cancer is associated with exposure to high levels of carbon tetrachloride. The rates are not significantly different when compared to rates in Franklin County and Tennessee. However, frequencies are very low, making statistical interpretations difficult at best.

Prostate Cancer

According to data in in-patient and out-patient hospital records and in mortality records, the rate of prostate cancer in Loudon County is not significantly different from the rate in Franklin County. Data from TCR indicates that Loudon County has a significantly higher incidence of prostate cancer than the rates in Franklin County and Tennessee. The rate of prostate cancer from in-patient hospital data in Loudon County is significantly greater than the rate in Tennessee. The age distributions of cases in Loudon and Franklin Counties and in Tennessee are not appreciably different. The cases are fairly evenly distributed across populated areas in Loudon County. According to TCR data Loudon County ranks 3rd for incidence of prostate cancer, but ranks 25th in deaths from prostate cancer.

Breast Cancer, Ovarian Cancer, Uterine and Other Female Reproductive Cancers

The rate of breast cancer in Loudon County is significantly higher than the rates for Franklin County and Tennessee when using data from the TCR. However, the rates using data from in-patient and out-patient records and mortality records are not significantly different.

The rate of ovarian cancer in Loudon County is significantly higher than the rates in Franklin County and Tennessee, using data from in-patient and out-patient hospital records. The rates derived from mortality records and TCR are not significantly different even though Loudon County ranks 6th in ovarian cancer using TCR data.

The rate of uterine cancer is not significantly different in Loudon County compared to the rates in Franklin County and Tennessee, using in-patient and out-patient data and mortality data. The rate is significantly higher using data from the TCR. Loudon County ranks 7th in uterine cancer incidence using data from the TCR.

The only significance difference for other reproductive cancers is that the death rate in Loudon County is higher than the death rate in Franklin County.

Other Respiratory Diseases

Asthma is of great interest in Loudon. Unfortunately, this is a difficult disease for which to obtain reliable data. EEP suspects that many cases of childhood asthma are missed. If children are seen by a private physician who is able to keep their asthma under control, all datasets will miss these cases. For females, males, and both sexes combined, Loudon County shows no statistical differences when compared to Franklin County and Tennessee.

The rates of chronic bronchitis are elevated in Loudon County compared to Franklin County and Tennessee for some datasets, but not all. Using out-patient data, females, males, and both sexes combined have significantly higher rates of chronic bronchitis compared to Franklin County and Tennessee. In-patient hospital data shows increases for Loudon County females, males, and both sexes combined compared to Tennessee. The death rate for Loudon County females was elevated in comparison to Franklin County females.

Using out-patient data, Loudon county females ranked 23th, males ranked 25th, and both sexes combined ranked 23rd. Using in-patient data, Loudon County females ranked 42nd, males ranked 25th, and both sexes combined ranked 23rd.

The data for acute respiratory infections are particularly difficult to interpret. Mostly, there are no significant differences between Loudon and Franklin Counties and Tennessee, although some diseases are significantly greater and some significantly less. No clear pattern emerges from the data for chronic obstructive pulmonary disease, emphysema, pneumoconiosis caused by external factors, pleurisy, pneumonia, and other respiratory diseases.

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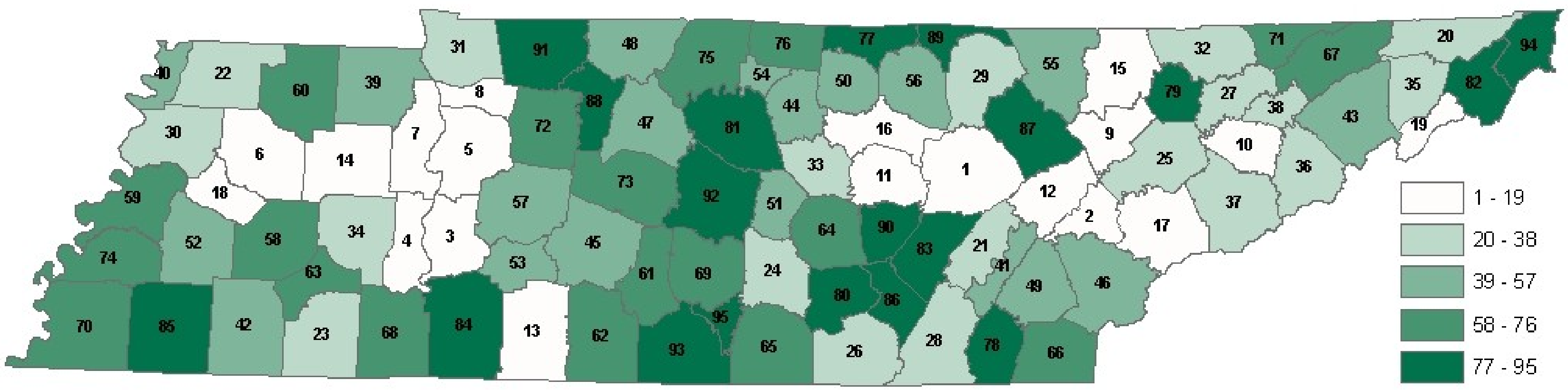
Appendix G

Rankings for Total Cancers

Rates expressed as per 100,000

Total TCRI Cases Ranked by Crude Rate



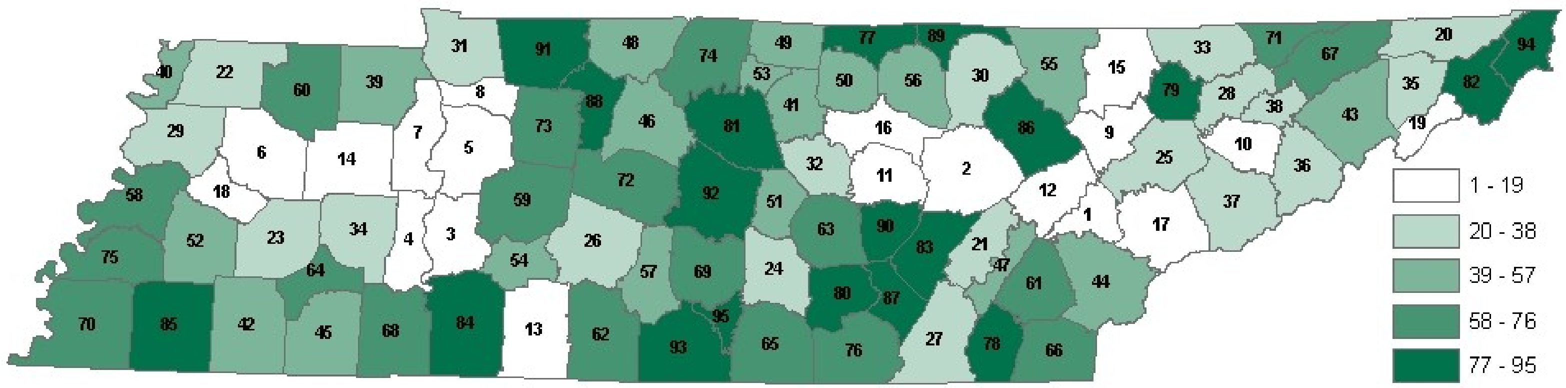
ALL CANCERS TOTAL TCRI CASES 1991-2000, Ranked by Crude Rates

County	Rank	Number	Crude Rate
Cumberland	1	2302	554.30 (531.66-576.94)
Loudon	2	1985	553.44 (529.09-577.78)
Perry	3	389	541.59 (487.77-595.42)
Decatur	4	599	534.75 (491.93-577.57)
Humphreys	5	881	520.36 (486-554.72)
Gibson	6	2423	509.52 (489.23-529.81)
Benton	7	803	507.21 (472.13-542.29)
Houston	8	389	503.47 (453.44-553.5)
Anderson	9	3522	495.34 (478.98-511.7)
Jefferson	10	1907	490.82 (468.79-512.85)
White	11	1056	486.76 (457.4-516.12)
Roane	12	2395	478.01 (458.86-497.15)
Lawrence	13	1823	476.33 (454.46-498.19)
Carroll	14	1359	473.86 (448.66-499.05)
Campbell	15	1754	465.02 (443.25-486.78)
Putnam	16	2659	459.42 (441.96-476.88)
Blount	17	4442	453.91 (440.56-467.26)
Crockett	18	629	451.21 (415.95-486.48)
Unicoi	19	774	450.64 (418.89-482.39)
Sullivan	20	6755	449.86 (439.13-460.59)
Rhea	21	1192	444.69 (419.45-469.94)
Obion	22	1415	440.83 (417.86-463.8)
Madison	23	1036	439.47 (412.71-466.24)
Coffee	24	1963	438.73 (419.32-458.14)
Knox	25	16062	437.50 (430.73-444.26)
Maury	26	1156	436.10 (410.96-461.24)
Grainger	27	825	434.34 (404.7-463.98)
Hamilton	28	13014	433.67 (426.22-441.12)
Fentress	29	676	429.92 (397.51-462.33)
Dyer	30	1550	429.35 (407.98-450.73)
Stewart	31	473	428.82 (390.18-467.47)
Claiborne	32	1207	425.62 (401.61-449.64)

County	Rank	Number	Crude Rate
DeKalb	33	682	425.22 (393.31-457.13)
Henderson	34	999	422.63 (396.42-448.84)
Washington	35	4222	417.94 (405.33-430.54)
Cocke	36	1318	417.81 (395.26-440.37)
Sevier	37	2601	417.06 (401.03-433.09)
Hamblen	38	2288	415.96 (398.91-433)
Henry	39	1235	414.84 (391.7-437.97)
Lake	40	326	409.85 (365.36-454.34)
Meigs	41	396	407.92 (367.75-448.1)
Hardeman	42	1063	407.54 (383.04-432.04)
Greene	43	2415	406.72 (390.5-422.94)
Smith	44	643	406.00 (374.62-437.38)
McNairy	45	2620	405.86 (390.32-421.4)
Monroe	46	1401	403.11 (382-424.22)
Davidson	47	22084	401.68 (396.39-406.98)
Robertson	48	1935	400.34 (382.5-418.18)
Macon	49	1839	398.09 (379.9-416.29)
Jackson	50	402	397.78 (358.89-436.66)
Cannon	51	466	397.66 (361.55-433.76)
Haywood	52	781	396.20 (368.41-423.99)
Lewis	53	419	395.93 (358.02-433.84)
Trousdale	54	259	394.93 (346.83-443.02)
Scott	55	782	392.74 (365.21-420.26)
Overton	56	734	390.36 (362.12-418.6)
Hickman	57	765	388.31 (360.79-415.83)
Marshall	58	3343	388.28 (375.12-401.44)
Lauderdale	59	995	387.58 (363.5-411.67)
Weakley	60	1280	382.22 (361.28-403.16)
McMinn	61	943	380.20 (355.93-404.46)
Giles	62	1067	379.54 (356.77-402.32)
Chester	63	535	375.46 (343.64-407.27)
Warren	64	1351	375.18 (355.18-395.19)

County	Rank	Number	Crude Rate
Franklin	65	1392	371.93 (352.39-391.47)
Polk	66	548	367.78 (336.98-398.57)
Hawkins	67	1800	362.86 (346.1-379.62)
Hardin	68	871	354.69 (331.14-378.25)
Bedford	69	1217	352.29 (332.5-372.09)
Shelby	70	30310	348.04 (344.12-351.96)
Hancock	71	235	345.01 (300.9-389.12)
Dickson	72	1349	343.29 (324.97-361.61)
Williamson	73	3582	342.07 (330.86-353.27)
Tipton	74	1526	339.00 (321.99-356.01)
Sumner	75	4020	338.83 (328.35-349.3)
Marion	76	615	338.11 (311.39-364.84)
Clay	77	252	330.54 (289.72-371.35)
Bradley	78	2690	329.59 (317.14-342.05)
Union	79	519	327.48 (299.31-355.66)
Grundy	80	454	326.96 (296.89-357.04)
Wilson	81	2546	322.64 (310.11-335.18)
Carter	82	1737	318.42 (303.44-333.39)
Bledsoe	83	351	317.41 (284.2-350.61)
Wayne	84	505	313.54 (286.2-340.89)
Fayette	85	826	313.46 (292.08-334.83)
Sequatchie	86	312	308.84 (274.57-343.11)
Morgan	87	579	308.62 (283.48-333.76)
Cheatham	88	975	304.13 (285.04-323.22)
Pickett	89	140	296.58 (247.45-345.71)
Van Buren	90	145	273.10 (228.65-317.55)
Montgomery	91	3195	266.72 (257.47-275.97)
Rutherford	92	4067	264.48 (256.35-272.6)
Lincoln	93	748	251.28 (233.27-269.29)
Johnson	94	409	247.35 (223.38-271.32)
Moore	95	106	198.14 (160.42-235.86)
Tennessee		209625	391.63 (389.95-393.31)

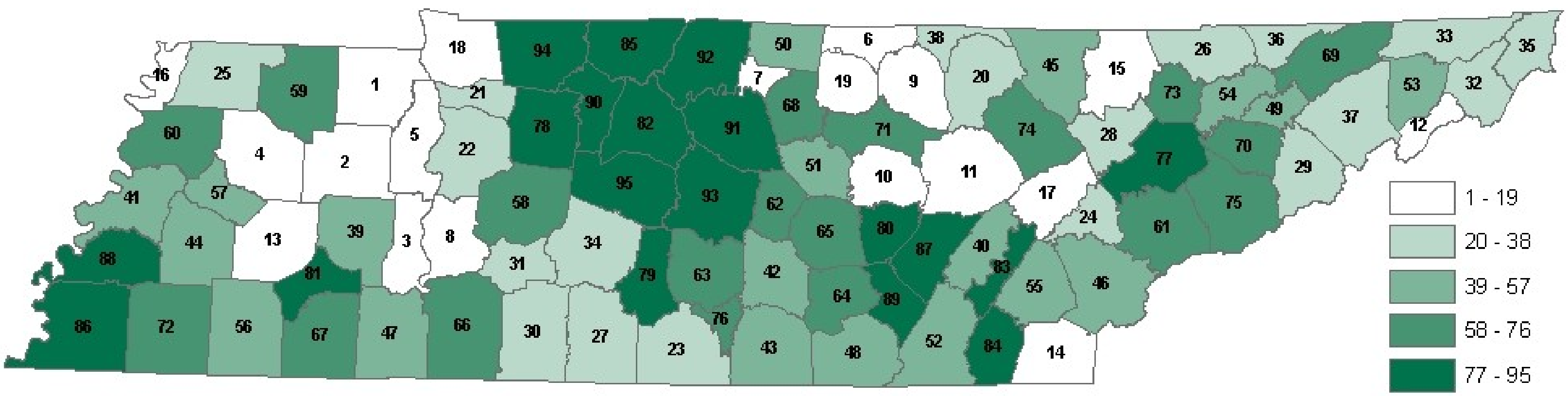
Total TCRI Cases Ranked by Mean Rate



ALL CANCERS TOTAL TCRI CASES 1991-2000, Ranked by Mean Rates

County	Rank	Number	Mean Rate
Loudon	1	1985	552.23 (527.94-576.52)
Cumberland	2	2302	547.79 (525.42-570.17)
Perry	3	389	540.08 (486.41-593.75)
Decatur	4	599	534.68 (491.86-577.49)
Humphreys	5	881	516.98 (482.84-551.12)
Gibson	6	2423	509.50 (489.21-529.79)
Benton	7	803	506.72 (471.67-541.77)
Houston	8	389	502.11 (452.21-552)
Anderson	9	3522	495.52 (479.15-511.88)
Jefferson	10	1907	490.47 (468.46-512.49)
White	11	1056	487.50 (458.1-516.9)
Roane	12	2395	477.89 (458.75-497.03)
Lawrence	13	1823	474.92 (453.12-496.72)
Carroll	14	1359	473.62 (448.44-498.8)
Campbell	15	1754	464.77 (443.02-486.52)
Putnam	16	2659	461.03 (443.5-478.55)
Blount	17	4442	453.36 (440.03-466.69)
Crockett	18	629	451.72 (416.42-487.02)
Unicoi	19	774	450.88 (419.12-482.65)
Sullivan	20	6755	449.66 (438.94-460.39)
Rhea	21	1192	445.05 (419.79-470.32)
Obion	22	1415	440.64 (417.68-463.6)
Madison	23	1036	439.89 (413.11-466.68)
Coffee	24	1963	439.78 (420.32-459.23)
Knox	25	16062	437.77 (431-444.54)
Maury	26	1156	435.41 (410.31-460.51)
Hamilton	27	13014	433.51 (426.06-440.96)
Grainger	28	825	433.27 (403.7-462.83)
Dyer	29	1550	429.76 (408.37-451.16)
Fentress	30	676	428.78 (396.46-461.11)
Stewart	31	473	428.33 (389.73-466.93)
DeKalb	32	682	427.50 (395.42-459.59)
Claiborne	33	1207	424.77 (400.8-448.73)
Henderson	34	999	422.41 (396.22-448.61)
Washington	35	4222	417.58 (404.99-430.18)
Cocke	36	1318	416.31 (393.83-438.78)
Sevier	37	2601	416.19 (400.2-432.18)
Hamblen	38	2288	415.57 (398.54-432.6)
Henry	39	1235	413.31 (390.26-436.36)
Lake	40	326	410.07 (365.55-454.58)
Smith	41	643	409.09 (377.47-440.71)
Hardeman	42	1063	407.71 (383.2-432.22)
Greene	43	2415	407.22 (390.98-423.47)
Monroe	44	1401	402.90 (381.8-423.99)
McNairy	45	2620	402.85 (387.42-418.27)
Davidson	46	22084	402.14 (396.84-407.45)
Meigs	47	396	400.51 (361.06-439.95)
Robertson	48	1935	399.49 (381.69-417.29)
Macon	49	1839	398.20 (380-416.39)
Jackson	50	402	398.08 (359.16-436.99)
Cannon	51	466	397.87 (361.75-434)
Haywood	52	781	396.38 (368.58-424.18)
Trousdale	53	259	393.55 (345.62-441.48)
Lewis	54	419	393.51 (355.83-431.19)
Scott	55	782	393.05 (365.5-420.6)
Overton	56	734	390.49 (362.24-418.74)
Marshall	57	3343	388.84 (375.66-402.02)
Lauderdale	58	995	388.13 (364.02-412.25)
Hickman	59	765	386.38 (359-413.77)
Weakley	60	1280	383.31 (362.31-404.31)
McMinn	61	943	378.89 (354.7-403.07)
Giles	62	1067	377.55 (354.9-400.21)
Warren	63	1351	376.15 (356.09-396.2)
Chester	64	535	374.58 (342.84-406.32)
Franklin	65	1392	369.57 (350.16-388.99)
Polk	66	548	365.78 (335.16-396.41)
Hawkins	67	1800	363.17 (346.39-379.94)
Hardin	68	871	354.18 (330.66-377.7)
Bedford	69	1217	350.90 (331.19-370.62)
Shelby	70	30310	347.99 (344.07-351.91)
Hancock	71	235	344.78 (300.7-388.86)
Williamson	72	3582	342.76 (331.53-353.98)
Dickson	73	1349	341.49 (323.26-359.71)
Sumner	74	4020	338.11 (327.66-348.57)
Tipton	75	1526	337.60 (320.66-354.54)
Marion	76	615	335.58 (309.06-362.1)
Clay	77	252	331.04 (290.17-371.92)
Bradley	78	2690	328.58 (316.16-341)
Union	79	519	326.65 (298.54-354.75)
Grundy	80	454	326.45 (296.42-356.47)
Wilson	81	2546	322.80 (310.26-335.34)
Carter	82	1737	318.02 (303.06-332.97)
Bledsoe	83	351	317.76 (284.52-351)
Wayne	84	505	313.67 (286.31-341.03)
Fayette	85	826	312.49 (291.18-333.8)
Morgan	86	579	309.47 (284.26-334.67)
Sequatchie	87	312	307.89 (273.73-342.06)
Cheatham	88	975	303.55 (284.49-322.6)
Pickett	89	140	295.49 (246.54-344.44)
Van Buren	90	145	272.71 (228.32-317.1)
Montgomery	91	3195	266.15 (256.92-275.38)
Rutherford	92	4067	261.83 (253.78-269.88)
Lincoln	93	748	250.89 (232.91-268.87)
Johnson	94	409	246.89 (222.96-270.82)
Moore	95	106	196.77 (159.31-234.24)
Tennessee		209625	391.46 (389.79-393.14)

Total Death Certificate Cases Ranked by Crude Rate



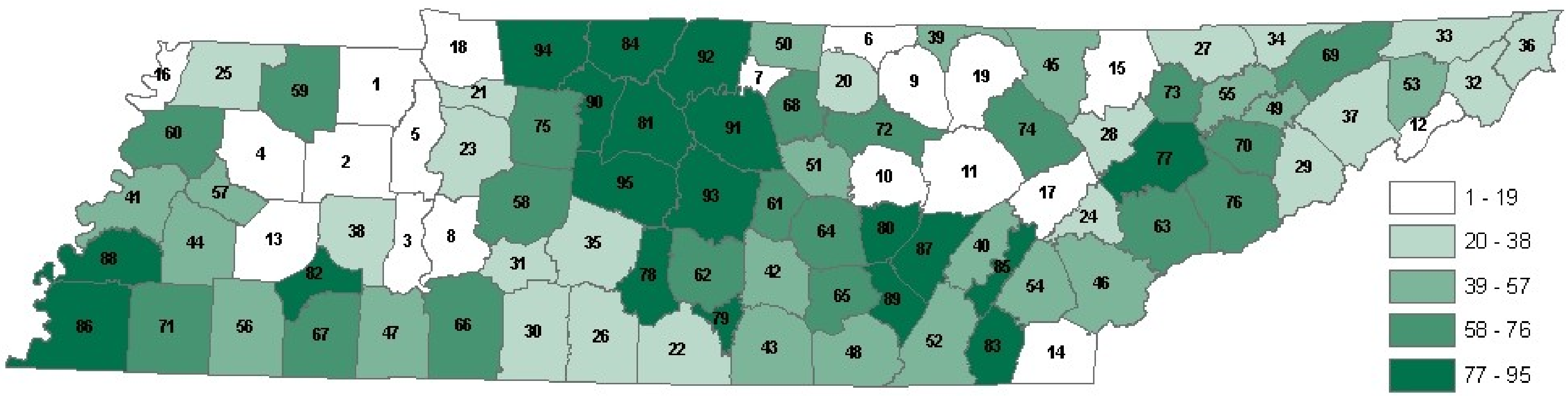
ALL CANCERS TOTAL DEATHS 1990-2003, Ranked by Crude Rate

County	Rank	Number	Crude Rate
Henry	1	1295	308.59 (291.78-325.4)
Carroll	2	1193	295.72 (278.94-312.5)
Decatur	3	466	295.37 (268.55-322.19)
Gibson	4	1952	292.74 (279.75-305.73)
Benton	5	639	286.84 (264.6-309.08)
Clay	6	308	286.52 (254.52-318.52)
Trousdale	7	267	284.96 (250.78-319.15)
Perry	8	287	282.96 (250.22-315.7)
Overton	9	738	276.76 (256.8-296.73)
White	10	845	274.92 (256.39-293.46)
Cumberland	11	1627	273.71 (260.41-287.01)
Unicoi	12	653	270.37 (249.63-291.11)
Madison	13	899	270.21 (252.55-287.87)
Polk	14	568	268.85 (246.74-290.96)
Campbell	15	1427	267.71 (253.82-281.6)
Lake	16	290	262.44 (232.23-292.65)
Roane	17	1851	262.35 (250.4-274.3)
Stewart	18	414	262.18 (236.92-287.43)
Jackson	19	376	261.29 (234.88-287.71)
Fentress	20	580	260.69 (239.48-281.91)
Houston	21	281	258.65 (228.4-288.89)
Humphreys	22	618	258.08 (237.73-278.42)
Lincoln	23	1086	257.85 (242.51-273.19)
Loudon	24	1307	256.21 (242.32-270.11)
Obion	25	1150	255.26 (240.5-270.01)
Claiborne	26	1016	253.66 (238.06-269.25)
Giles	27	1002	253.04 (237.38-268.71)
Anderson	28	2513	252.84 (242.95-262.72)
Cocke	29	1130	252.80 (238.06-267.53)
Lawrence	30	1359	251.93 (238.54-265.33)
Lewis	31	375	250.37 (225.03-275.71)
Carter	32	1923	250.34 (239.15-261.53)

County	Rank	Number	Crude Rate
Sullivan	33	5268	250.18 (243.43-256.94)
Maury	34	923	246.99 (231.05-262.92)
Johnson	35	574	246.94 (226.74-267.14)
Hancock	36	235	246.70 (215.16-278.24)
Greene	37	2065	245.64 (235.04-256.23)
Pickett	38	164	245.54 (207.96-283.12)
Henderson	39	821	244.35 (227.63-261.06)
Rhea	40	924	243.86 (228.14-259.58)
Lauderdale	41	878	241.83 (225.84-257.83)
Coffee	42	1533	241.54 (229.45-253.63)
Franklin	43	1275	241.17 (227.93-254.41)
Haywood	44	662	239.93 (221.65-258.21)
Scott	45	672	238.08 (220.08-256.08)
Monroe	46	1182	237.28 (223.76-250.81)
Hardin	47	817	236.13 (219.93-252.32)
Marion	48	612	235.06 (216.44-253.69)
Hamblen	49	1822	234.31 (223.55-245.07)
Macon	50	1530	233.98 (222.26-245.7)
DeKalb	51	525	230.16 (210.47-249.85)
Hamilton	52	9693	229.96 (225.38-234.54)
Washington	53	3278	229.22 (221.37-237.06)
Grainger	54	618	228.56 (210.54-246.58)
McMinn	55	802	227.92 (212.15-243.69)
Hardeman	56	839	226.60 (211.27-241.93)
Crockett	57	445	225.97 (204.97-246.96)
Hickman	58	639	225.88 (208.37-243.39)
Weakley	59	1062	224.82 (211.3-238.34)
Dyer	60	1140	224.12 (211.11-237.13)
Blount	61	3107	223.61 (215.75-231.47)
Cannon	62	372	222.95 (200.3-245.61)
Bedford	63	1096	222.49 (209.32-235.67)
Grundy	64	434	221.77 (200.9-242.63)

County	Rank	Number	Crude Rate
Warren	65	1126	220.81 (207.91-233.71)
Wayne	66	499	220.59 (201.24-239.95)
McNairy	67	1985	217.11 (207.56-226.66)
Smith	68	486	214.19 (195.14-233.23)
Hawkins	69	1505	213.80 (203-224.6)
Jefferson	70	1187	212.53 (200.44-224.62)
Putnam	71	1744	212.21 (202.25-222.17)
Fayette	72	802	212.10 (197.42-226.78)
Union	73	479	210.57 (191.71-229.43)
Morgan	74	558	210.49 (193.03-227.96)
Sevier	75	1880	209.84 (200.36-219.33)
Moore	76	158	208.88 (176.31-241.45)
Knox	77	10774	208.37 (204.44-212.31)
Dickson	78	1167	208.14 (196.2-220.09)
Marshall	79	2531	207.66 (199.57-215.75)
Van Buren	80	154	206.38 (173.79-238.98)
Chester	81	412	203.03 (183.42-222.63)
Davidson	82	15657	202.18 (199.01-205.34)
Meigs	83	278	199.83 (176.34-223.32)
Bradley	84	2309	199.16 (191.03-207.28)
Robertson	85	1373	197.84 (187.37-208.3)
Shelby	86	23975	195.51 (193.04-197.99)
Bledsoe	87	303	191.86 (170.26-213.46)
Tipton	88	1236	191.06 (180.4-201.71)
Sequatchie	89	276	190.39 (167.93-212.85)
Cheatham	90	845	184.18 (171.76-196.6)
Wilson	91	2022	178.49 (170.71-186.27)
Sumner	92	2997	177.01 (170.67-183.34)
Rutherford	93	3287	147.50 (142.45-152.54)
Montgomery	94	2520	146.93 (141.2-152.67)
Williamson	95	2013	131.71 (125.95-137.46)
Tennessee		162980	215.06 (214.02-216.1)

Total Death Certificate Cases Ranked by Mean Rate



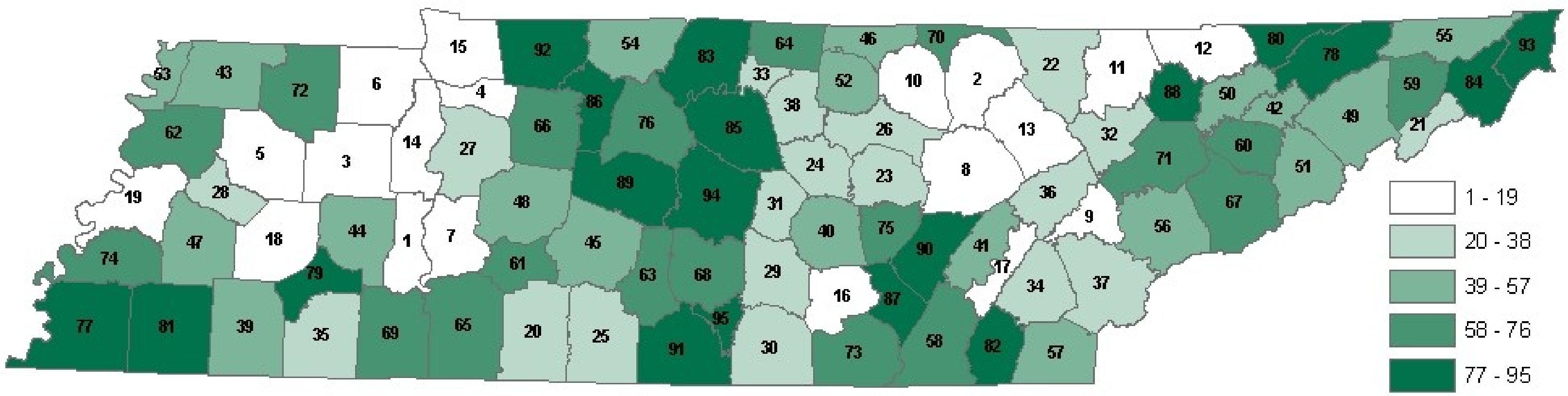
ALL CANCERS TOTAL DEATHS 1990-2003, Ranked by Mean Rates

County	Rank	Number	Mean Rate
Henry	1	1295	308.25 (291.47-325.04)
Carroll	2	1193	295.76 (278.97-312.54)
Decatur	3	466	295.13 (268.33-321.92)
Gibson	4	1952	292.72 (279.73-305.7)
Benton	5	639	286.76 (264.52-308.99)
Clay	6	308	286.55 (254.55-318.55)
Trousdale	7	267	284.43 (250.31-318.55)
Perry	8	287	282.11 (249.47-314.75)
Overton	9	738	276.50 (256.55-296.45)
White	10	845	275.03 (256.49-293.58)
Cumberland	11	1627	272.79 (259.54-286.05)
Unicoi	12	653	269.96 (249.25-290.67)
Madison	13	899	269.78 (252.15-287.42)
Polk	14	568	269.25 (247.11-291.4)
Campbell	15	1427	267.44 (253.56-281.32)
Lake	16	290	262.84 (232.59-293.09)
Roane	17	1851	262.01 (250.08-273.95)
Stewart	18	414	260.35 (235.27-285.43)
Fentress	19	580	260.10 (238.93-281.27)
Jackson	20	376	260.08 (233.79-286.36)
Houston	21	281	258.83 (228.57-289.09)
Lincoln	22	1086	257.82 (242.48-273.15)
Humphreys	23	618	257.48 (237.18-277.78)
Loudon	24	1307	255.80 (241.93-269.67)
Obion	25	1150	255.17 (240.42-269.91)
Giles	26	1002	253.05 (237.38-268.72)
Claiborne	27	1016	252.73 (237.19-268.27)
Anderson	28	2513	252.71 (242.83-262.59)
Cocke	29	1130	252.20 (237.5-266.91)
Lawrence	30	1359	251.76 (238.38-265.15)
Lewis	31	375	250.58 (225.22-275.94)
Carter	32	1923	250.18 (239-261.36)

County	Rank	Number	Mean Rate
Sullivan	33	5268	249.88 (243.13-256.63)
Hancock	34	235	246.73 (215.18-278.27)
Maury	35	923	246.31 (230.42-262.2)
Johnson	36	574	245.85 (225.74-265.96)
Greene	37	2065	245.05 (234.48-255.62)
Henderson	38	821	244.46 (227.74-261.18)
Pickett	39	164	244.35 (206.95-281.75)
Rhea	40	924	243.97 (228.24-259.7)
Lauderdale	41	878	242.19 (226.17-258.21)
Coffee	42	1533	241.56 (229.47-253.65)
Franklin	43	1275	240.70 (227.49-253.91)
Haywood	44	662	239.97 (221.69-258.25)
Scott	45	672	238.39 (220.37-256.42)
Monroe	46	1182	237.27 (223.74-250.79)
Hardin	47	817	235.87 (219.7-252.05)
Marion	48	612	235.60 (216.94-254.27)
Hamblen	49	1822	233.70 (222.97-244.43)
Macon	50	1530	232.96 (221.28-244.63)
DeKalb	51	525	231.45 (211.65-251.25)
Hamilton	52	9693	229.91 (225.33-234.49)
Washington	53	3278	229.13 (221.29-236.98)
McMinn	54	802	227.82 (212.05-243.58)
Grainger	55	618	227.53 (209.59-245.47)
Hardeman	56	839	226.66 (211.32-242)
Crockett	57	445	226.46 (205.42-247.5)
Hickman	58	639	225.85 (208.34-243.37)
Weakley	59	1062	225.19 (211.64-238.73)
Dyer	60	1140	224.13 (211.12-237.14)
Cannon	61	372	223.19 (200.51-245.87)
Bedford	62	1096	223.03 (209.82-236.23)
Blount	63	3107	222.90 (215.06-230.74)
Warren	64	1126	221.70 (208.75-234.65)

County	Rank	Number	Mean Rate
Grundy	65	434	220.94 (200.15-241.72)
Wayne	66	499	220.56 (201.21-239.92)
McNairy	67	1985	217.64 (208.07-227.22)
Smith	68	486	215.52 (196.36-234.68)
Hawkins	69	1505	213.37 (202.59-224.15)
Jefferson	70	1187	212.57 (200.47-224.66)
Fayette	71	802	212.55 (197.84-227.26)
Putnam	72	1744	211.69 (201.75-221.62)
Union	73	479	210.75 (191.87-229.62)
Morgan	74	558	210.64 (193.16-228.12)
Dickson	75	1167	209.24 (197.24-221.25)
Sevier	76	1880	208.57 (199.14-217.99)
Knox	77	10774	208.45 (204.52-212.39)
Marshall	78	2531	207.87 (199.77-215.97)
Moore	79	158	207.56 (175.2-239.92)
Van Buren	80	154	204.48 (172.18-236.77)
Davidson	81	15657	202.32 (199.15-205.49)
Chester	82	412	202.16 (182.64-221.68)
Bradley	83	2309	199.42 (191.29-207.56)
Robertson	84	1373	198.66 (188.15-209.16)
Meigs	85	278	197.12 (173.94-220.29)
Shelby	86	23975	195.73 (193.25-198.2)
Bledsoe	87	303	192.44 (170.77-214.11)
Tipton	88	1236	190.88 (180.24-201.52)
Sequatchie	89	276	189.09 (166.78-211.4)
Cheatham	90	845	184.94 (172.47-197.41)
Wilson	91	2022	177.72 (169.97-185.46)
Sumner	92	2997	176.09 (169.79-182.39)
Rutherford	93	3287	148.16 (143.09-153.22)
Montgomery	94	2520	146.89 (141.15-152.62)
Williamson	95	2013	132.36 (126.57-138.14)
Tennessee		162980	215.06 (214.02-216.1)

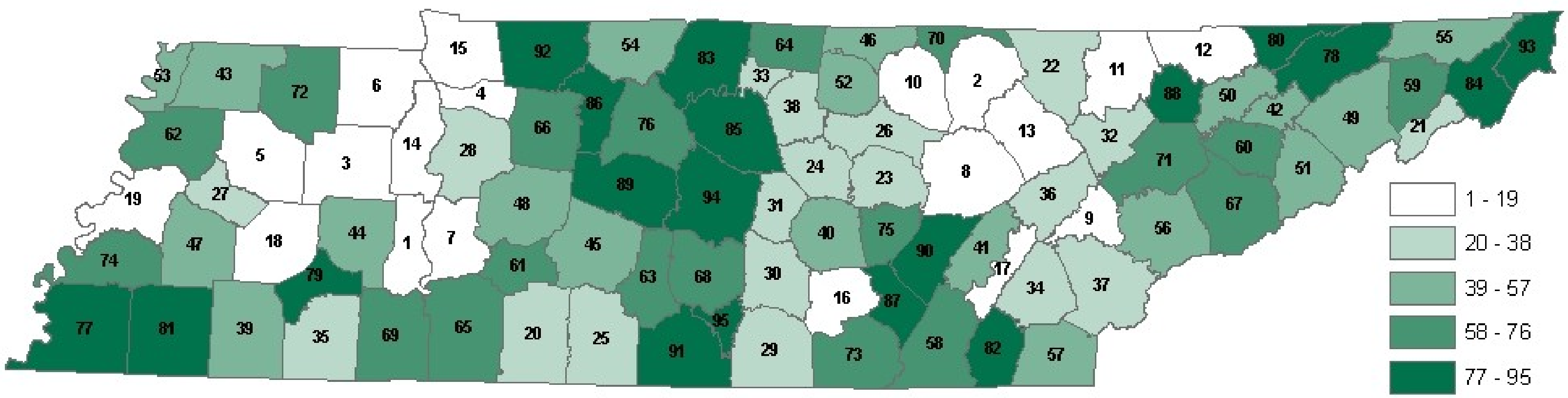
Total In-Patient Cases Ranked by Crude Rate



ALL CANCERS TOTAL IN-PATIENTS 1997-2003, Ranked by Crude Rates

County	Rank	Number	Crude Rate
Decatur	1	837	1023.01 (953.71-1092.32)
Fentress	2	1126	970.00 (913.35-1026.66)
Carroll	3	1889	916.09 (874.78-957.4)
Houston	4	517	911.54 (832.97-990.12)
Gibson	5	2999	888.34 (856.54-920.13)
Henry	6	1915	882.68 (843.14-922.21)
Perry	7	469	881.58 (801.79-961.37)
Cumberland	8	2852	876.16 (844-908.31)
Loudon	9	2359	862.89 (828.07-897.71)
Overton	10	1188	849.24 (800.95-897.54)
Campbell	11	2337	841.19 (807.08-875.29)
Claiborne	12	1744	836.74 (797.47-876.02)
Morgan	13	1150	832.78 (784.65-880.91)
Benton	14	953	824.49 (772.14-876.83)
Stewart	15	696	811.13 (750.87-871.39)
Grundy	16	807	803.97 (748.5-859.44)
Meigs	17	614	799.21 (735.99-862.43)
Madison	18	1357	790.92 (748.83-833)
Lauderdale	19	1496	788.38 (748.43-828.33)
Lawrence	20	2137	764.59 (732.17-797.01)
Unicoi	21	924	748.70 (700.42-796.98)
Scott	22	1092	738.74 (694.92-782.55)
White	23	1188	735.99 (694.14-777.84)
DeKalb	24	881	724.30 (676.48-772.13)
Giles	25	1484	722.03 (685.29-758.76)
Putnam	26	3122	715.11 (690.02-740.19)
Humphreys	27	891	712.00 (665.25-758.75)
Crockett	28	723	711.43 (659.57-763.29)
Coffee	29	2384	710.87 (682.33-739.4)
Franklin	30	1949	709.75 (678.24-741.26)
Cannon	31	631	708.79 (653.49-764.09)
Anderson	32	3541	707.74 (684.43-731.05)
Trousdale	33	354	705.01 (631.57-778.45)
McMinn	34	1319	704.59 (666.56-742.61)
McNairy	35	3428	702.85 (679.32-726.38)
Roane	36	2551	701.74 (674.51-728.98)
Monroe	37	1889	700.14 (668.57-731.72)
Smith	38	856	698.18 (651.41-744.96)
Hardeman	39	1367	698.16 (661.15-735.17)
Warren	40	1864	697.25 (665.59-728.9)
Rhea	41	1384	697.12 (660.39-733.85)
Hamblen	42	2818	693.58 (667.97-719.19)
Obion	43	1567	690.49 (656.3-724.68)
Henderson	44	1215	684.45 (645.97-722.94)
Maury	45	1324	683.83 (647-720.67)
Clay	46	379	682.96 (614.2-751.72)
Haywood	47	946	681.83 (638.38-725.28)
Hickman	48	1034	668.06 (627.34-708.78)
Greene	49	2918	666.63 (642.44-690.81)
Grainger	50	959	665.96 (623.81-708.11)
Cocke	51	1557	664.32 (631.32-697.32)
Jackson	52	505	661.29 (603.61-718.97)
Lake	53	370	660.71 (593.39-728.03)
Robertson	54	2494	656.67 (630.9-682.45)
Sullivan	55	7009	654.01 (638.7-669.32)
Blount	56	4819	652.58 (634.16-671.01)
Polk	57	721	646.94 (599.72-694.17)
Hamilton	58	13914	646.08 (635.34-656.81)
Washington	59	4839	645.31 (627.13-663.49)
Jefferson	60	1969	638.59 (610.38-666.79)
Lewis	61	500	628.80 (573.69-683.92)
Dyer	62	1635	627.37 (596.96-657.78)
Marshall	63	4002	625.48 (606.1-644.86)
Macon	64	2131	622.93 (596.48-649.38)
Wayne	65	735	621.24 (576.33-666.15)
Dickson	66	1856	616.95 (588.88-645.02)
Sevier	67	3033	613.95 (592.1-635.8)
Bedford	68	1611	612.40 (582.49-642.3)
Hardin	69	1089	608.46 (572.32-644.6)
Pickett	70	209	606.39 (524.18-688.61)
Knox	71	16228	605.61 (596.29-614.92)
Weakley	72	1454	596.90 (566.22-627.58)
Marion	73	839	593.83 (553.64-634.01)
Tipton	74	2099	588.79 (563.6-613.98)
Van Buren	75	225	583.13 (506.93-659.32)
Davidson	76	23046	575.79 (568.36-583.22)
Shelby	77	35963	572.34 (566.42-578.25)
Hawkins	78	2129	571.51 (547.23-595.79)
Chester	79	607	559.51 (515-604.03)
Hancock	80	261	548.61 (482.05-615.17)
Fayette	81	1063	530.91 (498.99-562.83)
Bradley	82	3202	520.53 (502.5-538.56)
Sumner	83	4706	516.28 (501.53-531.03)
Carter	84	2012	509.05 (486.81-531.29)
Wilson	85	3136	507.03 (489.28-524.77)
Cheatham	86	1262	503.65 (475.86-531.44)
Sequatchie	87	379	480.75 (432.35-529.15)
Union	88	588	473.43 (435.16-511.7)
Williamson	89	4090	466.55 (452.25-480.84)
Bledsoe	90	390	456.27 (410.98-501.55)
Lincoln	91	996	455.33 (427.05-483.61)
Montgomery	92	4053	431.45 (418.16-444.73)
Johnson	93	499	407.55 (371.79-443.31)
Rutherford	94	5074	400.77 (389.74-411.8)
Moore	95	120	300.63 (246.84-354.42)
Tennessee		246410	619.74 (617.29-622.19)

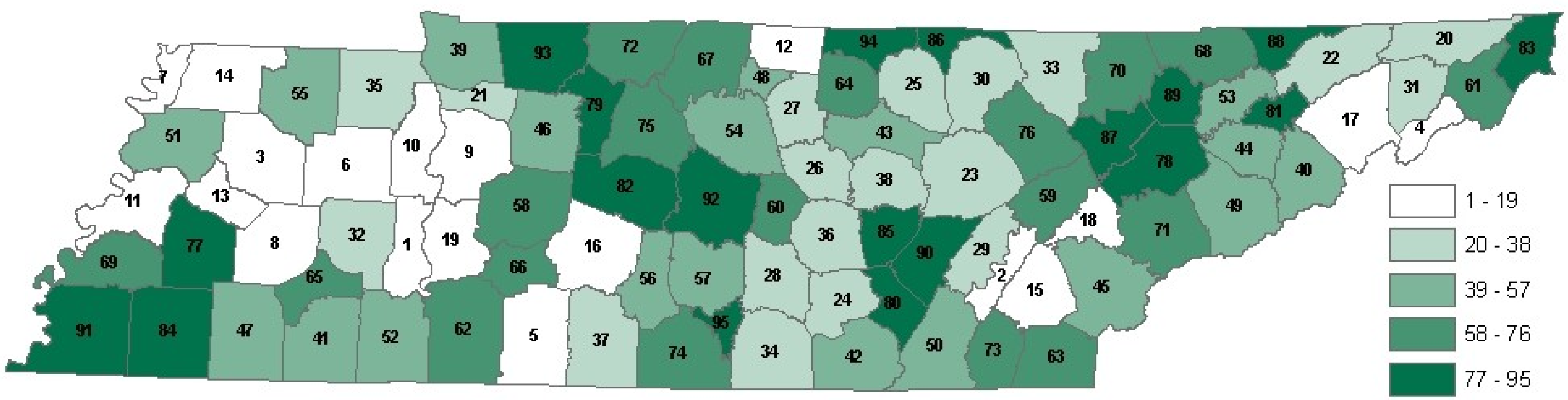
Total In-Patient Cases Ranked by Mean Rate



ALL CANCERS TOTAL IN-PATIENTS 1997-2003, Ranked by Mean Rates

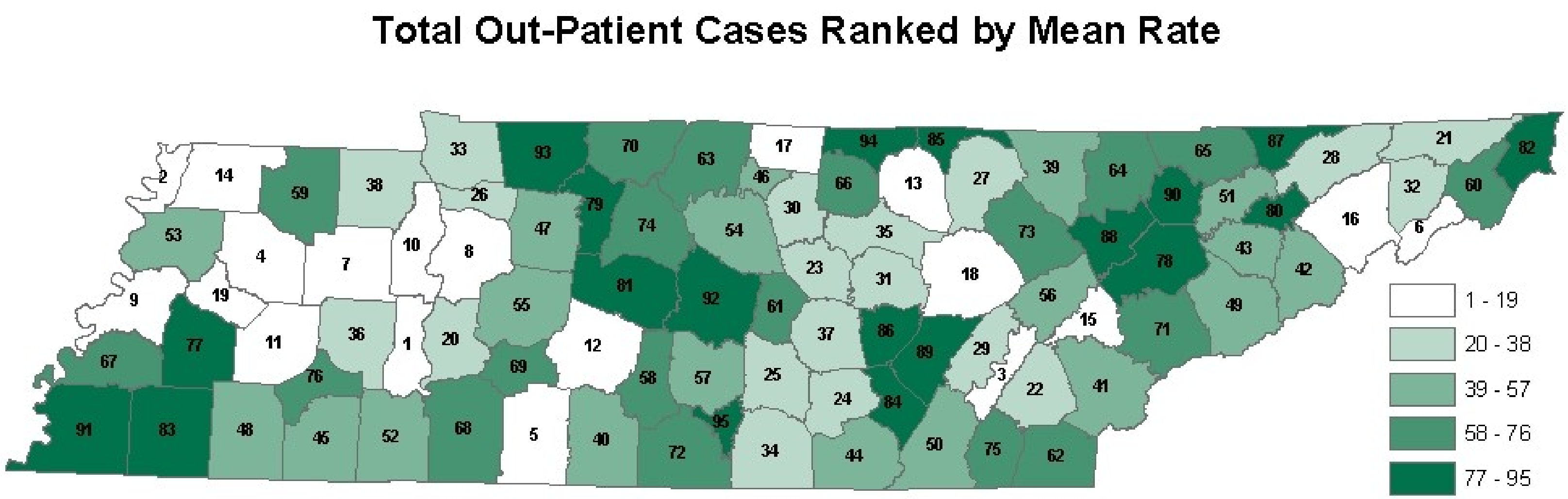
County	Rank	Number	Mean Rate
Decatur	1	837	1023.01 (953.7-1092.32)
Fentress	2	1126	968.56 (911.99-1025.14)
Carroll	3	1889	916.55 (875.22-957.88)
Houston	4	517	911.33 (832.78-989.89)
Gibson	5	2999	888.35 (856.56-920.14)
Henry	6	1915	882.25 (842.74-921.77)
Perry	7	469	881.27 (801.51-961.03)
Cumberland	8	2852	875.76 (843.62-907.9)
Loudon	9	2359	863.96 (829.09-898.82)
Overton	10	1188	848.99 (800.72-897.27)
Campbell	11	2337	841.27 (807.16-875.37)
Claiborne	12	1744	836.33 (797.08-875.59)
Morgan	13	1150	832.96 (784.82-881.11)
Benton	14	953	824.37 (772.03-876.71)
Stewart	15	696	809.44 (749.3-869.58)
Grundy	16	807	803.64 (748.19-859.08)
Meigs	17	614	800.06 (736.78-863.34)
Madison	18	1357	790.74 (748.67-832.82)
Lauderdale	19	1496	789.60 (749.59-829.62)
Lawrence	20	2137	764.71 (732.29-797.14)
Unicoi	21	924	748.77 (700.49-797.05)
Scott	22	1092	739.74 (695.86-783.61)
White	23	1188	734.84 (693.05-776.62)
DeKalb	24	881	725.36 (677.46-773.26)
Giles	25	1484	721.97 (685.24-758.7)
Putnam	26	3122	714.65 (689.58-739.72)
Crockett	27	723	711.76 (659.88-763.64)
Humphreys	28	891	711.75 (665.01-758.48)
Franklin	29	1949	710.37 (678.83-741.91)
Coffee	30	2384	710.26 (681.75-738.77)
Cannon	31	631	710.05 (654.65-765.45)
Anderson	32	3541	707.71 (684.4-731.02)
Trousdale	33	354	705.93 (632.39-779.47)
McMinn	34	1319	704.71 (666.68-742.74)
McNairy	35	3428	702.75 (679.22-726.27)
Roane	36	2551	701.79 (674.56-729.02)
Monroe	37	1889	700.27 (668.69-731.85)
Smith	38	856	699.58 (652.71-746.44)
Hardeman	39	1367	698.88 (661.83-735.93)
Warren	40	1864	697.71 (666.03-729.38)
Rhea	41	1384	697.00 (660.28-733.73)
Hamblen	42	2818	693.10 (667.51-718.69)
Obion	43	1567	690.38 (656.2-724.56)
Henderson	44	1215	685.39 (646.85-723.93)
Maury	45	1324	683.92 (647.08-720.76)
Clay	46	379	682.91 (614.16-751.66)
Haywood	47	946	681.87 (638.42-725.32)
Hickman	48	1034	667.42 (626.74-708.11)
Greene	49	2918	666.72 (642.53-690.91)
Grainger	50	959	665.18 (623.08-707.28)
Cocke	51	1557	663.94 (630.96-696.92)
Jackson	52	505	661.83 (604.1-719.55)
Lake	53	370	660.53 (593.22-727.83)
Robertson	54	2494	656.66 (630.89-682.43)
Sullivan	55	7009	654.03 (638.71-669.34)
Blount	56	4819	652.01 (633.61-670.42)
Polk	57	721	646.82 (599.6-694.03)
Hamilton	58	13914	646.07 (635.34-656.81)
Washington	59	4839	645.88 (627.68-664.08)
Jefferson	60	1969	638.79 (610.58-667.01)
Lewis	61	500	628.48 (573.39-683.57)
Dyer	62	1635	627.61 (597.18-658.03)
Marshall	63	4002	625.80 (606.41-645.19)
Macon	64	2131	622.70 (596.26-649.14)
Wayne	65	735	620.99 (576.1-665.89)
Dickson	66	1856	617.85 (589.74-645.96)
Sevier	67	3033	613.63 (591.79-635.47)
Bedford	68	1611	612.10 (582.21-641.99)
Hardin	69	1089	608.58 (572.44-644.73)
Pickett	70	209	606.03 (523.87-688.19)
Knox	71	16228	605.82 (596.5-615.14)
Weakley	72	1454	597.25 (566.55-627.95)
Marion	73	839	592.73 (552.63-632.84)
Tipton	74	2099	588.99 (563.79-614.18)
Van Buren	75	225	582.82 (506.66-658.97)
Davidson	76	23046	576.05 (568.61-583.49)
Shelby	77	35963	572.55 (566.64-578.47)
Hawkins	78	2129	571.07 (546.81-595.32)
Chester	79	607	561.24 (516.59-605.88)
Hancock	80	261	548.56 (482.01-615.12)
Fayette	81	1063	531.09 (499.16-563.02)
Bradley	82	3202	520.66 (502.63-538.7)
Sumner	83	4706	514.64 (499.93-529.34)
Carter	84	2012	508.88 (486.64-531.11)
Wilson	85	3136	507.06 (489.31-524.81)
Cheatham	86	1262	503.69 (475.9-531.48)
Sequatchie	87	379	481.63 (433.14-530.12)
Union	88	588	474.00 (435.69-512.31)
Williamson	89	4090	468.02 (453.68-482.36)
Bledsoe	90	390	456.17 (410.9-501.45)
Lincoln	91	996	454.96 (426.7-483.21)
Montgomery	92	4053	431.46 (418.18-444.75)
Johnson	93	499	407.20 (371.47-442.93)
Rutherford	94	5074	400.56 (389.54-411.58)
Moore	95	120	302.13 (248.07-356.19)
Tennessee		246410	619.92 (617.47-622.36)

Total Out-Patient Cases Ranked by Crude Rate



ALL CANCERS TOTAL OUT-PATIENTS 1998-2003, Ranked by Crude Rates

County	Rank	Number	Crude Rate
Decatur	1	677	963.22 (890.66-1035.78)
Meigs	2	502	754.24 (688.26-820.22)
Gibson	3	2139	739.18 (707.86-770.51)
Unicoi	4	764	720.70 (669.6-771.81)
Lawrence	5	1665	692.67 (659.4-725.95)
Carroll	6	1226	691.74 (653.02-730.46)
Lake	7	329	687.65 (613.34-761.96)
Madison	8	1016	687.44 (645.17-729.71)
Humphreys	9	739	685.62 (636.19-735.06)
Benton	10	663	667.75 (616.92-718.58)
Lauderdale	11	1088	665.23 (625.7-704.76)
Macon	12	1895	643.05 (614.09-672)
Crockett	13	562	642.50 (589.38-695.62)
Obion	14	1244	638.56 (603.08-674.05)
McMinn	15	1017	629.51 (590.82-668.2)
Maury	16	1048	629.06 (590.97-667.14)
Greene	17	2344	620.90 (595.76-646.04)
Loudon	18	1457	617.49 (585.78-649.19)
Perry	19	282	616.66 (544.69-688.64)
Sullivan	20	5549	603.63 (587.75-619.51)
Houston	21	294	603.21 (534.26-672.17)
Hawkins	22	1934	601.18 (574.39-627.97)
Cumberland	23	1693	600.78 (572.17-629.4)
Grundy	24	515	596.93 (545.37-648.48)
Overton	25	716	593.73 (550.24-637.22)
DeKalb	26	616	586.74 (540.41-633.08)
Smith	27	623	586.69 (540.62-632.76)
Coffee	28	1694	585.91 (558.01-613.81)
Rhea	29	985	576.49 (540.49-612.49)
Fentress	30	576	575.72 (528.71-622.74)
Washington	31	3710	574.48 (555.99-592.96)
Henderson	32	868	566.61 (528.91-604.3)
Scott	33	716	561.76 (520.61-602.91)
Franklin	34	1323	559.83 (529.67-590)
Henry	35	1032	553.05 (519.31-586.79)
Warren	36	1268	550.36 (520.07-580.65)
Giles	37	972	549.58 (515.03-584.13)
White	38	759	545.58 (506.76-584.39)
Stewart	39	403	541.96 (489.04-594.87)
Cocke	40	1094	541.68 (509.58-573.77)
McNairy	41	2264	538.41 (516.23-560.59)
Marion	42	658	537.92 (496.82-579.03)
Putnam	43	2025	537.72 (514.3-561.14)
Jefferson	44	1426	533.74 (506.04-561.45)
Monroe	45	1244	531.65 (502.11-561.2)
Dickson	46	1383	531.58 (503.57-559.6)
Hardeman	47	897	530.46 (495.74-565.17)
Trousdale	48	228	525.22 (457.05-593.4)
Sevier	49	2223	518.63 (497.07-540.19)
Hamilton	50	9439	510.58 (500.28-520.88)
Dyer	51	1142	509.91 (480.33-539.48)
Hardin	52	780	506.65 (471.09-542.2)
Grainger	53	622	500.09 (460.79-539.39)
Wilson	54	2677	499.02 (480.11-517.92)
Weakley	55	1037	495.11 (464.98-525.25)
Marshall	56	2723	493.43 (474.89-511.96)
Bedford	57	1113	489.54 (460.78-518.31)
Hickman	58	642	478.05 (441.07-515.03)
Roane	59	1474	471.92 (447.82-496.01)
Cannon	60	361	469.82 (421.35-518.29)
Carter	61	1595	469.3 (446.27-492.33)
Wayne	62	473	465.69 (423.72-507.66)
Polk	63	444	461.96 (418.99-504.93)
Jackson	64	303	459.86 (408.08-511.64)
Chester	65	430	459.12 (415.72-502.51)
Lewis	66	314	458.48 (407.77-509.19)
Sumner	67	3568	452.88 (438.02-467.74)
Claiborne	68	813	452.54 (421.44-483.65)
Tipton	69	1396	451.53 (427.84-475.21)
Campbell	70	1069	447.01 (420.21-473.8)
Blount	71	2848	446.75 (430.34-463.16)
Robertson	72	1456	442.43 (419.71-465.16)
Bradley	73	2329	439.06 (421.23-456.89)
Lincoln	74	825	437.77 (407.9-467.65)
Davidson	75	14821	431.16 (424.22-438.1)
Morgan	76	508	427.13 (389.99-464.27)
Haywood	77	495	416.93 (380.2-453.66)
Knox	78	9481	411.70 (403.42-419.99)
Cheatham	79	889	410.12 (383.16-437.08)
Sequatchie	80	274	400.49 (353.07-447.91)
Hamblen	81	1397	399.30 (378.36-420.24)
Williamson	82	3037	396.53 (382.43-410.64)
Johnson	83	416	394.77 (356.83-432.71)
Fayette	84	671	387.00 (357.72-416.28)
Van Buren	85	121	365.37 (300.27-430.47)
Pickett	86	107	360.34 (292.06-428.62)
Anderson	87	1511	352.55 (334.78-370.33)
Hancock	88	143	350.81 (293.31-408.31)
Union	89	377	350.47 (315.09-385.85)
Bledsoe	90	254	343.36 (301.13-385.59)
Shelby	91	18525	342.89 (337.95-347.82)
Rutherford	92	3284	298.05 (287.86-308.25)
Montgomery	93	2340	287.95 (276.29-299.62)
Clay	94	135	283.02 (235.28-330.77)
Moore	95	96	279.28 (226.22-341.05)
Tennessee		159556	465.71 (463.42-467.99)


Total Out-Patient Cases Ranked by Mean Rate
1 - 19
20 - 38
39 - 57
58 - 76
77 - 95

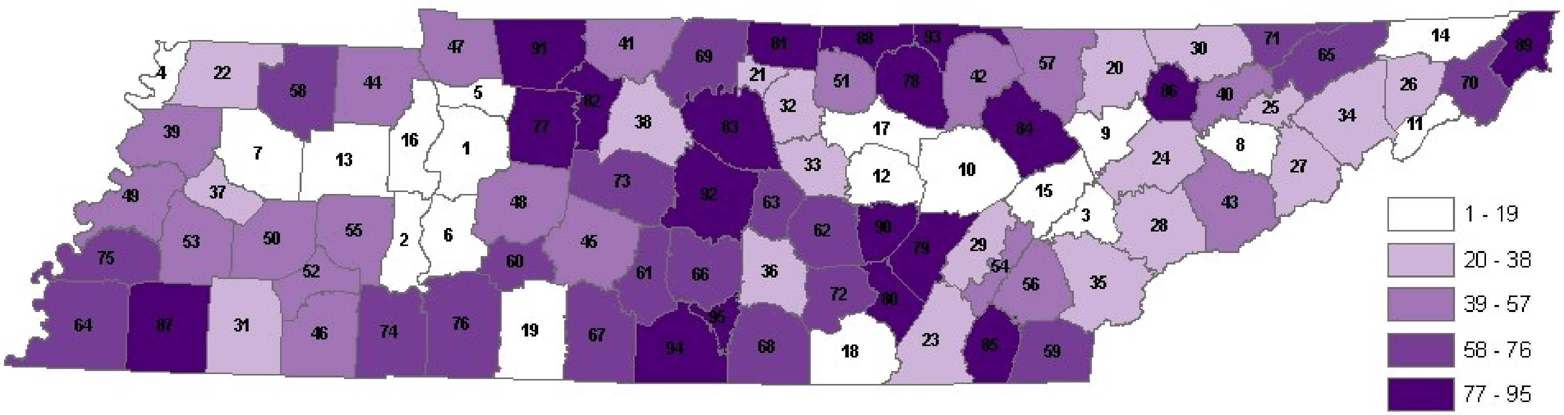
ALL CANCERS TOTAL OUT-PATIENTS 1998-2003, Ranked by Mean Rates

County	Rank	Number	Mean Rate
Decatur	1	677	791.09 (731.5-850.68)
Lake	2	329	687.75 (613.44-762.07)
Meigs	3	502	649.55 (592.73-706.37)
Gibson	4	2139	622.77 (596.38-649.16)
Lawrence	5	1665	613.98 (584.49-643.47)
Unicoi	6	764	612.01 (568.61-655.41)
Carroll	7	1226	611.22 (577.01-645.44)
Humphreys	8	739	596.66 (553.64-639.68)
Lauderdale	9	1088	588.42 (553.45-623.38)
Benton	10	663	588.33 (543.54-633.11)
Madison	11	1016	572.92 (537.69-608.15)
Maury	12	1048	554.60 (521.02-588.18)
Overton	13	716	544.35 (504.48-584.22)
Obion	14	1244	544.32 (514.07-574.57)
Loudon	15	1457	540.86 (513.09-568.64)
Greene	16	2344	540.67 (518.78-562.56)
Macon	17	1895	539.38 (515.09-563.66)
Cumberland	18	1693	537.29 (511.7-562.89)
Crockett	19	562	535.21 (490.96-579.46)
Perry	20	282	533.65 (471.36-595.93)
Sullivan	21	5549	533.09 (519.07-547.12)
McMinn	22	1017	530.75 (498.13-563.37)
DeKalb	23	616	527.79 (486.11-569.47)
Grundy	24	515	524.58 (479.28-569.89)
Coffee	25	1694	524.42 (499.45-549.4)
Houston	26	294	523.13 (463.33-582.92)
Fentress	27	576	519.61 (477.17-562.04)
Hawkins	28	1934	519.23 (496.09-542.37)
Rhea	29	985	517.19 (484.89-549.49)
Smith	30	623	513.56 (473.23-553.88)
White	31	759	496.40 (461.08-531.71)
Washington	32	3710	491.05 (475.25-506.85)

County	Rank	Number	Mean Rate
Stewart	33	403	486.38 (438.9-533.87)
Franklin	34	1323	483.41 (457.36-509.46)
Putnam	35	2025	483.12 (462.08-504.16)
Henderson	36	868	482.76 (450.65-514.88)
Warren	37	1268	481.70 (455.19-508.21)
Henry	38	1032	478.49 (449.29-507.68)
Scott	39	716	475.73 (440.89-510.58)
Giles	40	972	473.99 (444.19-503.79)
Monroe	41	1244	470.61 (444.45-496.76)
Cocke	42	1094	470.06 (442.2-497.91)
Jefferson	43	1426	468.79 (444.46-493.12)
Marion	44	658	467.81 (432.07-503.56)
McNairy	45	2264	462.94 (443.88-482.01)
Trousdale	46	228	460.91 (401.08-520.74)
Dickson	47	1383	460.56 (436.29-484.83)
Hardeman	48	897	455.37 (425.57-485.18)
Sevier	49	2223	455.08 (436.16-474)
Hamilton	50	9439	448.38 (439.33-457.43)
Grainger	51	622	441.54 (406.84-476.24)
Hardin	52	780	438.76 (407.97-469.55)
Dyer	53	1142	438.25 (412.83-463.67)
Wilson	54	2677	437.99 (421.4-454.58)
Hickman	55	642	430.23 (396.95-463.51)
Roane	56	1474	426.87 (405.07-448.66)
Bedford	57	1113	423.23 (398.37-448.1)
Marshall	58	2723	420.28 (404.5-436.07)
Weakley	59	1037	417.41 (392-442.81)
Carter	60	1595	409.57 (389.47-429.67)
Cannon	61	361	404.88 (363.12-446.65)
Polk	62	444	403.37 (365.85-440.89)
Sumner	63	3568	401.07 (387.91-414.23)
Campbell	64	1069	398.35 (374.47-422.23)

County	Rank	Number	Mean Rate
Claiborne	65	813	397.19 (369.88-424.49)
Jackson	66	303	396.03 (351.44-440.62)
Tipton	67	1396	395.36 (374.62-416.1)
Wayne	68	473	393.22 (357.78-428.66)
Lewis	69	314	390.09 (346.94-433.24)
Robertson	70	1456	389.29 (369.29-409.29)
Blount	71	2848	388.37 (374.1-402.63)
Lincoln	72	825	387.81 (361.34-414.27)
Morgan	73	508	384.50 (351.06-417.93)
Davidson	74	14821	383.92 (377.74-390.11)
Bradley	75	2329	375.43 (360.18-390.68)
Chester	76	430	374.27 (338.89-409.64)
Haywood	77	495	366.39 (334.11-398.66)
Knox	78	9481	365.18 (357.83-372.54)
Cheatham	79	889	363.44 (339.55-387.33)
Hamblen	80	1397	348.45 (330.17-366.72)
Williamson	81	3037	347.79 (335.42-360.16)
Johnson	82	416	346.14 (312.88-379.4)
Fayette	83	671	340.67 (314.9-366.45)
Sequatchie	84	274	339.74 (299.51-379.97)
Pickett	85	107	326.93 (264.99-388.88)
Van Buren	86	121	322.59 (265.11-380.06)
Hancock	87	143	321.32 (268.65-373.98)
Anderson	88	1511	318.91 (302.83-334.99)
Bledsoe	89	254	305.57 (267.99-343.15)
Union	90	377	303.73 (273.07-334.39)
Shelby	91	18525	295.02 (290.77-299.27)
Rutherford	92	3284	268.09 (258.92-277.25)
Montgomery	93	2340	258.72 (248.24-269.2)
Clay	94	135	257.27 (213.87-300.67)
Moore	95	96	250.80 (203.15-306.27)
Tennessee		159556	407.46 (405.46-409.46)

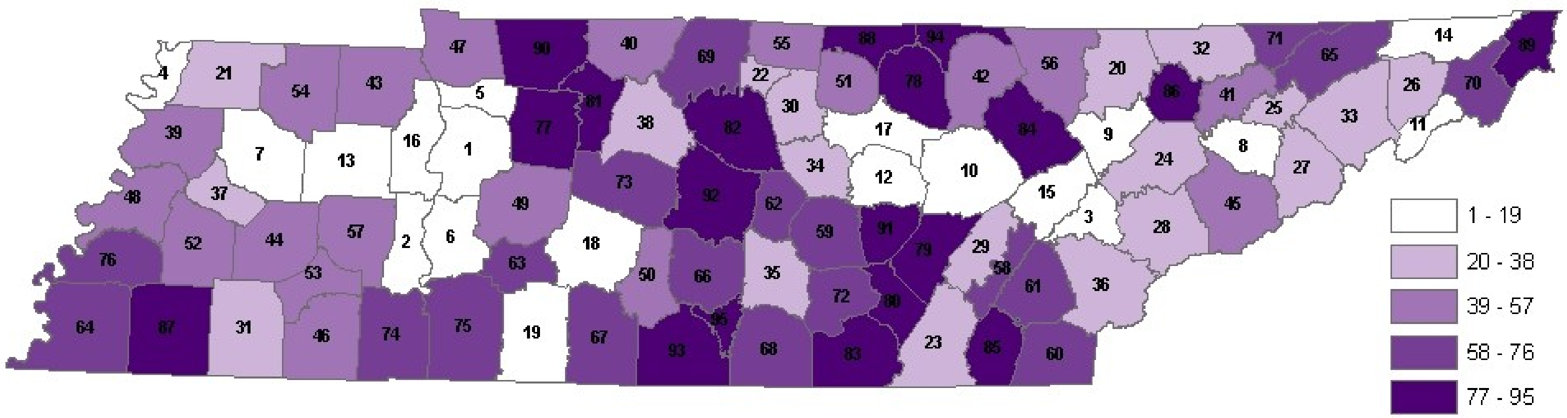
Females TCRI Cases Ranked by Crude Rate



ALL CANCERS FEMALE TCRI CASES 1991-2000, ranked by Crude Rates

County	Rank	Number	Crude Rate
Humphreys	1	486	564.01 (513.86-614.15)
Decatur	2	298	514.07 (455.7-572.44)
Loudon	3	931	503.09 (470.77-535.4)
Lake	4	164	496.58 (420.58-572.58)
Houston	5	193	490.97 (421.7-560.24)
Perry	6	178	489.20 (417.33-561.07)
Gibson	7	1183	470.03 (443.25-496.81)
Jefferson	8	902	456.35 (426.57-486.13)
Anderson	9	1694	455.16 (433.49-476.84)
Cumberland	10	970	453.10 (424.58-481.61)
Unicoi	11	396	446.01 (402.08-489.94)
White	12	490	440.13 (401.16-479.1)
Carroll	13	653	437.69 (404.12-471.26)
Sullivan	14	3404	436.87 (422.19-451.55)
Roane	15	1130	436.21 (410.78-461.64)
Benton	16	358	434.77 (389.73-479.8)
Putnam	17	1262	430.43 (406.68-454.18)
Maury	18	583	430.12 (395.2-465.03)
Lawrence	19	846	427.50 (398.69-456.3)
Campbell	20	836	425.67 (396.81-454.52)
Trousdale	21	143	425.62 (355.86-495.38)
Obion	22	709	424.84 (393.57-456.11)
Hamilton	23	6633	421.23 (411.09-431.37)
Knox	24	8030	421.21 (412-430.42)
Hamblen	25	1190	420.77 (396.86-444.68)
Washington	26	2172	417.59 (400.03-435.15)
Cocke	27	674	413.70 (382.47-444.94)
Blount	28	2089	412.52 (394.83-430.21)
Rhea	29	561	405.14 (371.61-438.66)
Claiborne	30	592	403.97 (371.42-436.51)
Hardeman	31	513	403.76 (368.82-438.7)
Smith	32	327	402.87 (359.2-446.53)
DeKalb	33	330	399.74 (356.61-442.87)
Greene	34	1221	399.51 (377.1-421.92)
Monroe	35	709	399.36 (369.96-428.76)
Coffee	36	919	398.53 (372.76-424.3)
Crockett	37	289	396.85 (351.09-442.6)
Davidson	38	11300	394.36 (387.09-401.63)
Dyer	39	743	393.31 (365.03-421.59)
Grainger	40	371	387.66 (348.21-427.1)
Robertson	41	947	386.23 (361.63-410.83)
Fentress	42	310	386.20 (343.2-429.19)
Sevier	43	1224	383.34 (361.87-404.82)
Henry	44	590	382.35 (351.5-413.21)
McNairy	45	1277	382.12 (361.16-403.08)
Madison	46	463	380.16 (345.53-414.79)
Stewart	47	211	379.37 (328.18-430.56)
Lauderdale	48	478	376.51 (342.76-410.26)
Hickman	49	353	376.51 (337.23-415.78)
Marshall	50	1687	373.87 (356.03-391.71)
Jackson	51	190	369.00 (316.53-421.47)
Chester	52	272	368.98 (325.13-412.83)
Haywood	53	387	368.36 (331.66-405.06)
Meigs	54	178	367.81 (313.77-421.84)
Henderson	55	450	366.87 (332.97-400.77)
Macon	56	881	366.52 (342.32-390.73)
Scott	57	372	366.22 (329-403.43)
Weakley	58	633	365.45 (336.98-393.92)
Polk	59	267	354.42 (311.91-396.93)
Lewis	60	190	352.85 (302.67-403.02)
McMinn	61	450	352.38 (319.82-384.94)
Warren	62	652	352.15 (325.12-379.18)
Cannon	63	211	351.57 (304.13-399)
Shelby	64	15978	350.35 (344.92-355.79)
Hawkins	65	879	345.34 (322.51-368.17)
Bedford	66	599	339.60 (312.4-366.8)
Giles	67	492	339.55 (309.54-369.55)
Franklin	68	639	333.62 (307.75-359.49)
Sumner	69	2011	331.85 (317.35-346.36)
Carter	70	928	330.05 (308.81-351.28)
Hancock	71	115	329.49 (269.27-389.72)
Grundy	72	233	327.35 (285.32-369.39)
Williamson	73	1738	326.51 (311.16-341.87)
Hardin	74	407	323.58 (292.14-355.02)
Tipton	75	741	323.02 (299.77-346.28)
Wayne	76	241	321.11 (280.57-361.65)
Dickson	77	643	319.45 (294.76-344.14)
Overton	78	300	312.66 (277.28-348.04)
Bledsoe	79	156	311.70 (262.79-360.61)
Sequatchie	80	158	309.25 (261.03-357.47)
Marion	81	283	304.41 (268.95-339.88)
Cheatham	82	487	304.25 (277.23-331.27)
Wilson	83	1208	302.37 (285.32-319.42)
Morgan	84	262	297.82 (261.76-333.89)
Bradley	85	1226	291.68 (275.36-308.01)
Union	86	233	291.64 (254.19-329.09)
Fayette	87	374	277.45 (249.33-305.57)
Clay	88	107	273.46 (221.65-325.28)
Johnson	89	211	271.73 (235.06-308.39)
Van Buren	90	71	266.16 (207.87-335.72)
Montgomery	91	1577	266.04 (252.91-279.17)
Rutherford	92	2045	263.51 (252.09-274.93)
Pickett	93	60	249.05 (190.05-320.57)
Lincoln	94	382	248.17 (223.29-273.06)
Moore	95	55	203.58 (153.36-264.98)
Tennessee		103984	376.64 (374.35-378.93)

Females TCRI Cases Ranked by Mean Rate



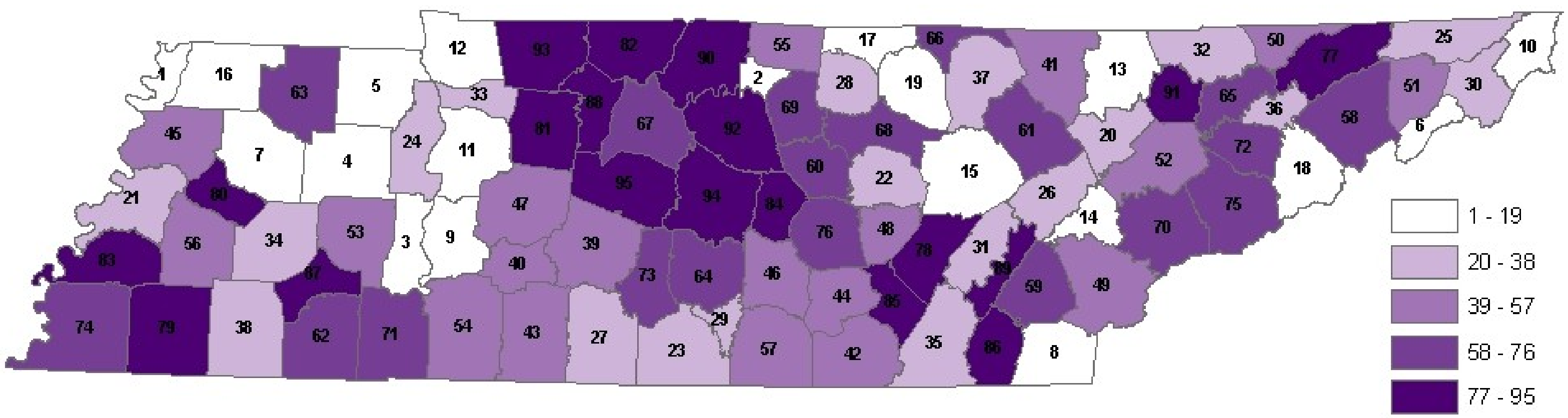
ALL CANCERS FEMALE TCRI CASES 1991-2000, Ranked by Mean Rates

County	Rank	Number	Mean Rate
Humphreys	1	486	559.26 (509.54-608.98)
Decatur	2	298	512.21 (454.05-570.36)
Loudon	3	931	501.41 (469.2-533.62)
Lake	4	164	495.82 (419.94-571.71)
Houston	5	193	489.96 (420.83-559.08)
Perry	6	178	487.24 (415.66-558.81)
Gibson	7	1183	469.60 (442.84-496.36)
Jefferson	8	902	455.78 (426.04-485.53)
Anderson	9	1694	455.22 (433.54-476.89)
Cumberland	10	970	446.51 (418.41-474.61)
Unicoi	11	396	445.99 (402.07-489.92)
White	12	490	440.38 (401.38-479.37)
Carroll	13	653	437.00 (403.49-470.52)
Sullivan	14	3404	436.69 (422.02-451.36)
Roane	15	1130	435.58 (410.18-460.98)
Benton	16	358	432.77 (387.94-477.6)
Putnam	17	1262	431.33 (407.53-455.12)
Maury	18	583	428.84 (394.02-463.65)
Lawrence	19	846	426.76 (398-455.52)
Campbell	20	836	425.11 (396.29-453.92)
Obion	21	709	424.65 (393.39-455.9)
Trousdale	22	143	423.24 (353.87-492.61)
Hamilton	23	6633	421.14 (411.01-431.28)
Knox	24	8030	420.88 (411.68-430.09)
Hamblen	25	1190	419.89 (396.04-443.75)
Washington	26	2172	416.97 (399.44-434.51)
Cocke	27	674	412.59 (381.44-443.74)
Blount	28	2089	411.68 (394.02-429.33)
Rhea	29	561	404.80 (371.3-438.3)
Smith	30	327	404.63 (360.77-448.48)
Hardeman	31	513	403.59 (368.66-438.51)
Claiborne	32	592	402.96 (370.5-435.42)

County	Rank	Number	Mean Rate
Greene	33	1221	400.22 (377.77-422.67)
DeKalb	34	330	400.16 (356.99-443.34)
Coffee	35	919	398.74 (372.96-424.52)
Monroe	36	709	398.17 (368.86-427.47)
Crockett	37	289	396.88 (351.12-442.64)
Davidson	38	11300	394.47 (387.2-401.75)
Dyer	39	743	393.31 (365.03-421.59)
Robertson	40	947	385.27 (360.73-409.81)
Grainger	41	371	384.84 (345.68-424.01)
Fentress	42	310	384.61 (341.79-427.42)
Henry	43	590	380.48 (349.77-411.18)
Madison	44	463	379.87 (345.26-414.47)
Sevier	45	1224	379.75 (358.48-401.03)
McNairy	46	1277	378.85 (358.07-399.62)
Stewart	47	211	376.75 (325.92-427.59)
Lauderdale	48	478	376.53 (342.78-410.29)
Hickman	49	353	376.17 (336.92-415.41)
Marshall	50	1687	373.51 (355.69-391.34)
Jackson	51	190	369.21 (316.71-421.71)
Haywood	52	387	368.59 (331.87-405.32)
Chester	53	272	367.88 (324.16-411.6)
Weakley	54	633	366.36 (337.82-394.9)
Macon	55	881	366.28 (342.09-390.46)
Scott	56	372	365.94 (328.75-403.12)
Henderson	57	450	365.18 (331.44-398.92)
Meigs	58	178	359.18 (306.41-411.94)
Warren	59	652	353.48 (326.35-380.61)
Polk	60	267	351.84 (309.64-394.04)
McMinn	61	450	351.51 (319.03-383.99)
Cannon	62	211	350.79 (303.46-398.13)
Lewis	63	190	350.47 (300.64-400.31)
Shelby	64	15978	350.27 (344.83-355.7)

County	Rank	Number	Mean Rate
Hawkins	65	879	345.26 (322.44-368.09)
Bedford	66	599	338.07 (311-365.14)
Giles	67	492	337.57 (307.74-367.4)
Franklin	68	639	331.57 (305.86-357.28)
Sumner	69	2011	331.24 (316.76-345.72)
Carter	70	928	329.71 (308.5-350.92)
Hancock	71	115	329.60 (269.35-389.84)
Grundy	72	233	326.83 (284.87-368.8)
Williamson	73	1738	323.88 (308.66-339.11)
Hardin	74	407	322.96 (291.58-354.33)
Wayne	75	241	321.10 (280.56-361.64)
Tipton	76	741	320.55 (297.47-343.63)
Dickson	77	643	317.49 (292.95-342.03)
Overton	78	300	313.34 (277.88-348.8)
Bledsoe	79	156	311.02 (262.21-359.82)
Sequatchie	80	158	309.25 (261.03-357.48)
Cheatham	81	487	301.80 (274.99-328.6)
Wilson	82	1208	301.72 (284.7-318.73)
Marion	83	283	301.70 (266.55-336.86)
Morgan	84	262	297.81 (261.74-333.87)
Bradley	85	1226	290.27 (274.02-306.52)
Union	86	233	288.83 (251.74-325.92)
Fayette	87	374	276.89 (248.83-304.95)
Clay	88	107	273.08 (221.33-324.82)
Johnson	89	211	270.65 (234.13-307.17)
Montgomery	90	1577	265.67 (252.56-278.79)
Van Buren	91	71	264.62 (206.67-333.78)
Rutherford	92	2045	260.84 (249.53-272.15)
Lincoln	93	382	248.30 (223.4-273.2)
Pickett	94	60	248.26 (189.45-319.56)
Moore	95	55	202.44 (152.51-263.5)
Tennessee		103984	376.18 (373.89-378.46)

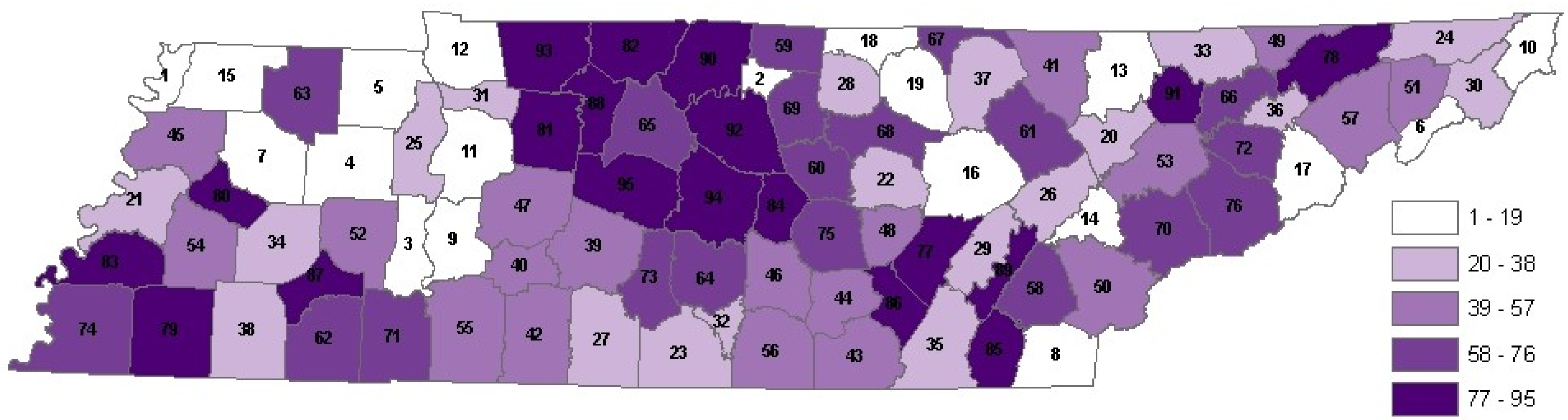
Females Death Certificate Cases Ranked by Crude Rate



ALL CANCERS FEMALE DEATHS 1990-2003, Ranked by Crude Rates

County	Rank	Number	Crude Rate
Lake	1	141	307.87 (257.05-358.68)
Trousdale	2	128	267.00 (220.74-313.26)
Decatur	3	216	264.96 (229.62-300.29)
Carroll	4	550	262.11 (240.2-284.02)
Henry	5	564	259.48 (238.07-280.9)
Unicoi	6	319	255.98 (227.89-284.07)
Gibson	7	896	254.09 (237.45-270.73)
Polk	8	265	248.16 (218.28-278.03)
Perry	9	124	241.60 (199.08-284.13)
Johnson	10	261	238.47 (209.54-267.41)
Humphreys	11	286	234.76 (207.56-261.97)
Stewart	12	185	232.51 (199.01-266.02)
Campbell	13	632	227.94 (210.17-245.71)
Loudon	14	595	226.39 (208.2-244.58)
Cumberland	15	688	224.52 (207.74-241.29)
Obion	16	525	224.42 (205.22-243.62)
Clay	17	123	222.97 (183.57-262.38)
Cocke	18	514	222.86 (203.59-242.13)
Overton	19	302	221.92 (196.89-246.95)
Anderson	20	1154	221.79 (208.99-234.58)
Lauderdale	21	395	220.96 (199.17-242.75)
White	22	347	220.25 (197.08-243.43)
Lincoln	23	478	219.64 (199.95-239.33)
Benton	24	254	219.57 (192.56-246.57)
Sullivan	25	2396	219.39 (210.6-228.17)
Roane	26	798	218.91 (203.72-234.09)
Giles	27	446	218.70 (198.4-239)
Jackson	28	158	215.86 (182.2-249.52)
Moore	29	82	214.69 (170.75-266.49)
Carter	30	842	212.78 (198.4-227.15)
Rhea	31	416	212.67 (192.23-233.1)
Claiborne	32	440	212.49 (192.64-232.35)
Houston	33	117	211.87 (173.48-250.26)
Madison	34	363	211.30 (189.57-233.04)
Hamilton	35	4656	210.75 (204.69-216.8)
Hamblen	36	836	209.82 (195.59-224.04)
Fentress	37	238	209.67 (183.03-236.3)
Hardeman	38	374	209.11 (187.91-230.3)
Maury	39	399	208.91 (188.41-229.41)
Lewis	40	159	208.74 (176.3-241.19)
Scott	41	296	205.85 (182.4-229.3)
Marion	42	273	205.58 (181.19-229.97)
Lawrence	43	572	205.28 (188.45-222.1)
Grundy	44	204	203.66 (175.71-231.6)
Dyer	45	538	202.29 (185.19-219.38)
Coffee	46	658	201.42 (186.03-216.81)
Hickman	47	269	200.19 (176.27-224.11)
Van Buren	48	75	200.11 (157.4-250.84)
Monroe	49	506	199.19 (181.83-216.54)
Hancock	50	97	198.89 (161.29-242.63)
Washington	51	1454	197.57 (187.42-207.73)
Knox	52	5283	196.96 (191.65-202.27)
Henderson	53	343	196.80 (175.97-217.63)
Wayne	54	207	196.66 (169.87-223.45)
Macon	55	668	196.59 (181.68-211.49)
Haywood	56	289	196.58 (173.91-219.24)
Franklin	57	532	196.54 (179.83-213.24)
Greene	58	848	196.15 (182.95-209.36)
McMinn	59	354	195.68 (175.29-216.06)
DeKalb	60	228	194.97 (169.66-220.27)
Morgan	61	241	194.00 (169.51-218.49)
McNairy	62	911	192.78 (180.26-205.3)
Weakley	63	467	191.37 (174.01-208.73)
Bedford	64	479	191.03 (173.93-208.14)
Grainger	65	260	191.01 (167.79-214.23)
Pickett	66	65	190.90 (147.33-243.31)
Davidson	67	7670	190.53 (186.26-194.79)
Putnam	68	788	189.58 (176.34-202.82)
Smith	69	217	187.03 (162.14-211.91)
Blount	70	1340	186.44 (176.46-196.43)
Hardin	71	328	185.39 (165.33-205.45)
Jefferson	72	523	184.27 (168.48-200.07)
Marshall	73	1159	181.72 (171.26-192.19)
Shelby	74	11616	181.00 (177.71-184.3)
Sevier	75	828	180.59 (168.29-192.89)
Warren	76	468	179.01 (162.79-195.23)
Hawkins	77	646	178.81 (165.02-192.6)
Bledsoe	78	127	177.62 (146.73-208.51)
Fayette	79	342	177.07 (158.3-195.84)
Crockett	80	181	176.38 (150.69-202.08)
Dickson	81	505	176.03 (160.68-191.38)
Robertson	82	612	174.18 (160.38-187.98)
Tipton	83	573	173.88 (159.64-188.12)
Cannon	84	147	172.16 (144.33-199.99)
Sequatchie	85	125	170.53 (140.63-200.42)
Bradley	86	1007	168.82 (158.4-179.25)
Chester	87	176	167.91 (143.1-192.71)
Cheatham	88	380	165.91 (149.23-182.59)
Meigs	89	115	165.68 (135.4-195.96)
Sumner	90	1401	162.05 (153.56-170.54)
Union	91	185	161.35 (138.1-184.61)
Wilson	92	882	153.76 (143.61-163.9)
Montgomery	93	1159	136.48 (128.63-144.34)
Rutherford	94	1479	131.66 (124.95-138.37)
Williamson	95	914	117.66 (110.03-125.28)
Tennessee		74672	191.25 (189.88-192.62)

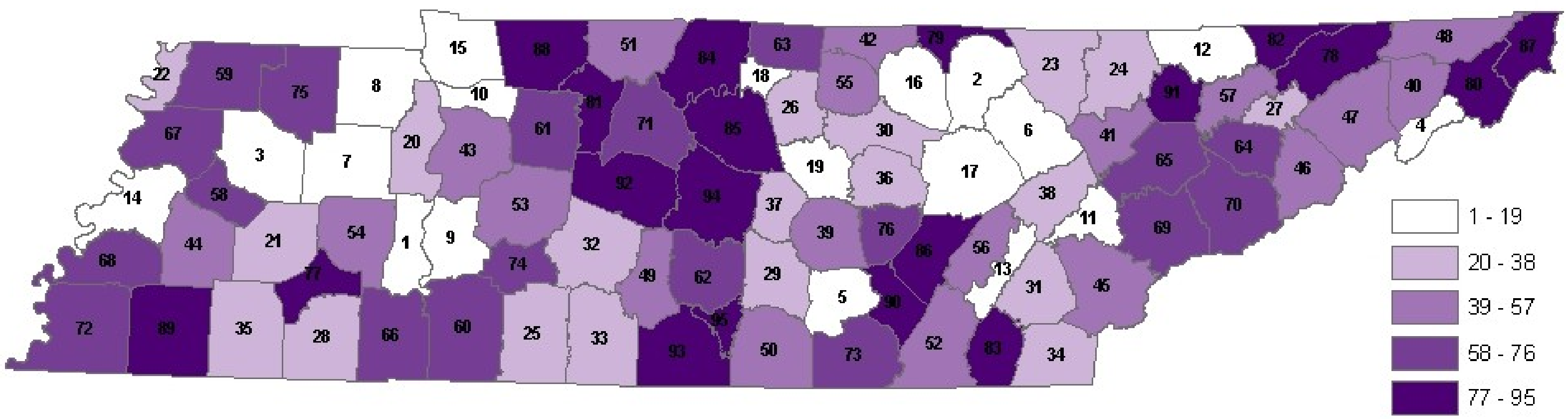
Female Death Certificate Cases Ranked by Mean Rate



ALL CANCERS FEMALE DEATHS 1990-2003, Ranked by Mean Rates

County	Rank	Number	Mean Rate
Lake	1	141	308.78 (257.82-359.75)
Trousdale	2	128	266.08 (219.99-312.18)
Decatur	3	216	264.34 (229.09-299.6)
Carroll	4	550	262.39 (240.46-284.32)
Henry	5	564	259.29 (237.89-280.68)
Unicoi	6	319	255.52 (227.48-283.56)
Gibson	7	896	254.08 (237.44-270.71)
Polk	8	265	247.55 (217.74-277.35)
Perry	9	124	241.07 (198.64-283.5)
Johnson	10	261	237.58 (208.75-266.4)
Humphreys	11	286	234.56 (207.37-261.74)
Stewart	12	185	228.80 (195.83-261.77)
Campbell	13	632	227.98 (210.2-245.75)
Loudon	14	595	225.6 (207.47-243.72)
Obion	15	525	224.44 (205.24-243.64)
Cumberland	16	688	223.37 (206.68-240.06)
Cocke	17	514	222.76 (203.5-242.02)
Clay	18	123	221.76 (182.57-260.96)
Overton	19	302	221.74 (196.73-246.74)
Anderson	20	1154	221.72 (208.93-234.51)
Lauderdale	21	395	220.58 (198.83-242.34)
White	22	347	220.10 (196.94-243.26)
Lincoln	23	478	219.74 (200.04-239.44)
Sullivan	24	2396	219.14 (210.36-227.91)
Benton	25	254	218.77 (191.87-245.67)
Roane	26	798	218.62 (203.45-233.79)
Giles	27	446	218.36 (198.1-238.63)
Jackson	28	158	215.72 (182.08-249.36)
Rhea	29	416	212.73 (192.29-233.17)
Carter	30	842	212.36 (198.01-226.7)
Houston	31	117	212.23 (173.77-250.68)
Moore	32	82	212.2 (168.77-263.39)
Claiborne	33	440	210.86 (191.15-230.56)
Madison	34	363	210.71 (189.03-232.38)
Hamilton	35	4656	210.66 (204.6-216.71)
Hamblen	36	836	209.00 (194.83-223.17)
Fentress	37	238	208.97 (182.42-235.52)
Hardeman	38	374	208.63 (187.49-229.77)
Maury	39	399	208.49 (188.03-228.94)
Lewis	40	159	208.44 (176.04-240.84)
Scott	41	296	205.60 (182.18-229.02)
Lawrence	42	572	205.05 (188.24-221.85)
Marion	43	273	204.41 (180.16-228.66)
Grundy	44	204	203.07 (175.2-230.94)
Dyer	45	538	202.08 (185-219.16)
Coffee	46	658	201.14 (185.77-216.51)
Hickman	47	269	200.73 (176.74-224.72)
Van Buren	48	75	199.40 (156.84-249.95)
Hancock	49	97	199.19 (161.53-242.99)
Monroe	50	506	198.97 (181.63-216.31)
Washington	51	1454	197.65 (187.49-207.81)
Henderson	52	343	197.15 (176.28-218.01)
Knox	53	5283	196.87 (191.56-202.18)
Haywood	54	289	196.57 (173.91-219.23)
Wayne	55	207	196.32 (169.57-223.06)
Franklin	56	532	196.18 (179.51-212.85)
Greene	57	848	195.96 (182.77-209.15)
McMinn	58	354	195.75 (175.36-216.14)
Macon	59	668	195.33 (180.52-210.14)
DeKalb	60	228	194.85 (169.56-220.15)
Morgan	61	241	193.27 (168.87-217.67)
McNairy	62	911	192.46 (179.96-204.96)
Weakley	63	467	191.69 (174.3-209.08)
Bedford	64	479	191.47 (174.33-208.62)
Davidson	65	7670	190.55 (186.29-194.82)
Grainger	66	260	190.14 (167.03-213.25)
Pickett	67	65	189.09 (145.94-241.02)
Putnam	68	788	188.69 (175.52-201.86)
Smith	69	217	187.84 (162.85-212.84)
Blount	70	1340	185.62 (175.68-195.56)
Hardin	71	328	185.22 (165.18-205.27)
Jefferson	72	523	183.18 (167.48-198.88)
Marshall	73	1159	181.18 (170.75-191.61)
Shelby	74	11616	181.09 (177.79-184.38)
Warren	75	468	179.36 (163.11-195.61)
Sevier	76	828	178.89 (166.7-191.07)
Bledsoe	77	127	178.27 (147.26-209.27)
Hawkins	78	646	178.15 (164.41-191.89)
Fayette	79	342	177.48 (158.67-196.29)
Crockett	80	181	176.64 (150.91-202.37)
Dickson	81	505	176.23 (160.86-191.6)
Robertson	82	612	174.04 (160.25-187.83)
Tipton	83	573	172.72 (158.58-186.86)
Cannon	84	147	171.32 (143.62-199.01)
Bradley	85	1007	168.83 (158.41-179.26)
Sequatchie	86	125	167.43 (138.08-196.79)
Chester	87	176	167.04 (142.36-191.72)
Cheatham	88	380	165.42 (148.78-182.05)
Meigs	89	115	163.91 (133.95-193.86)
Sumner	90	1401	160.95 (152.52-169.38)
Union	91	185	160.37 (137.26-183.48)
Wilson	92	882	153.80 (143.65-163.96)
Montgomery	93	1159	135.98 (128.15-143.8)
Rutherford	94	1479	131.77 (125.05-138.48)
Williamson	95	914	118.79 (111.09-126.49)
Tennessee		74672	191.07 (189.7-192.44)

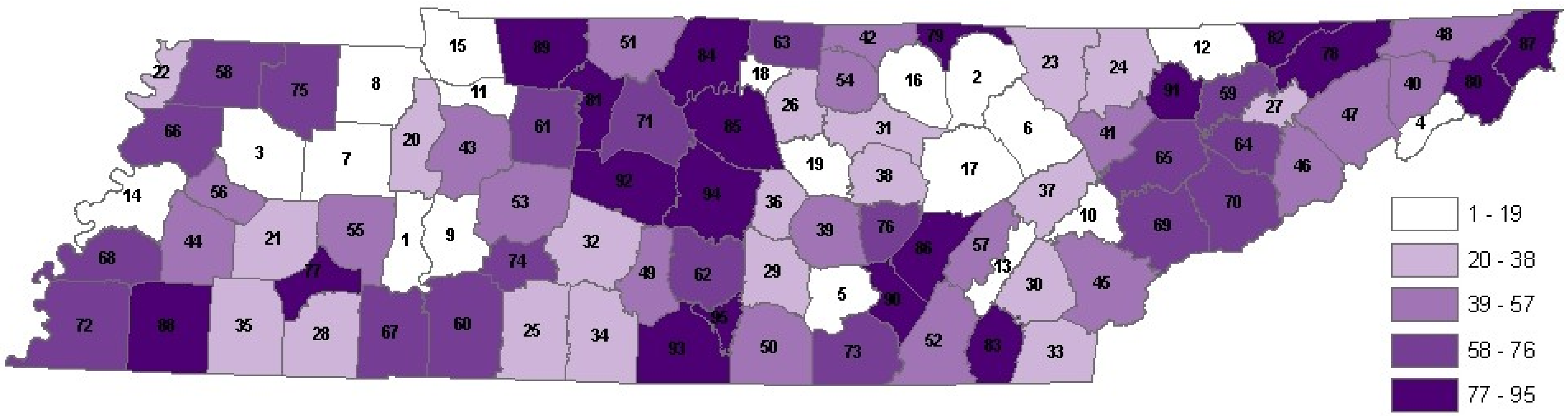
Female In-Patient Cases Ranked by Crude Rate



ALL CANCERS FEMALE IN-PATIENTS 1997-2003, Ranked by Crude Rates

County	Rank	Number	Crude Rate
Decatur	1	405	960.83 (867.25-1054.41)
Fentress	2	518	875.22 (799.85-950.59)
Gibson	3	1558	874.5 (831.08-917.93)
Unicoi	4	532	840.03 (768.65-911.41)
Grundy	5	427	835.16 (755.94-914.37)
Morgan	6	526	816.28 (746.52-886.03)
Carroll	7	874	814.7 (760.69-868.71)
Henry	8	912	812.64 (759.9-865.38)
Perry	9	215	802.12 (694.9-909.34)
Houston	10	230	800.86 (697.36-904.37)
Loudon	11	1124	800.36 (753.57-847.16)
Claiborne	12	857	794.40 (741.21-847.59)
Meigs	13	296	771.72 (683.8-859.63)
Lauderdale	14	702	766.40 (709.71-823.1)
Stewart	15	328	760.79 (678.46-843.13)
Overton	16	539	755.03 (691.29-818.77)
Cumberland	17	1263	753.13 (711.59-794.66)
Trousdale	18	192	750.62 (644.44-856.79)
DeKalb	19	458	742.59 (674.58-810.6)
Benton	20	442	740.93 (671.85-810)
Madison	21	655	740.59 (683.87-797.31)
Lake	22	165	739.51 (681.94-797.08)
Scott	23	547	729.68 (668.53-790.83)
Campbell	24	1027	712.54 (668.96-756.12)
Lawrence	25	1008	700.38 (657.14-743.62)
Smith	26	432	693.00 (627.65-758.35)
Hamblen	27	1426	690.35 (654.52-726.18)
McNairy	28	1697	676.01 (643.85-708.18)
Coffee	29	1158	672.80 (634.05-711.55)
Putnam	30	1480	672.49 (638.23-706.76)
McMinn	31	645	672.33 (620.44-724.22)
Maury	32	655	662.64 (611.89-713.39)
Giles	33	699	661.57 (612.52-710.61)
Polk	34	372	661.36 (594.15-728.56)
Hardeman	35	603	660.00 (607.32-712.68)
White	36	542	657.99 (602.59-713.39)
Cannon	37	299	657.63 (583.09-732.18)
Roane	38	1232	657.04 (620.35-693.73)
Warren	39	889	652.79 (609.88-695.71)
Washington	40	2508	651.02 (625.54-676.5)
Anderson	41	1702	649.64 (618.78-680.51)
Clay	42	184	644.08 (551.01-737.14)
Humphreys	43	408	641.40 (579.16-703.64)
Haywood	44	472	638.29 (580.71-695.88)
Monroe	45	872	636.39 (594.15-678.63)
Cocke	46	767	636.20 (591.17-681.22)
Greene	47	1416	630.54 (597.7-663.38)
Sullivan	48	3491	629.12 (608.25-649.99)
Marshall	49	2090	627.13 (600.25-654.02)
Franklin	50	881	624.71 (583.46-665.96)
Robertson	51	1193	623.19 (587.82-658.55)
Hamilton	52	6998	622.41 (607.83-636.99)
Hickman	53	453	621.54 (564.31-678.78)
Henderson	54	559	607.45 (557.09-657.81)
Jackson	55	235	607.42 (529.76-685.09)
Rhea	56	620	606.46 (558.72-654.2)
Grainger	57	438	605.20 (548.52-661.88)
Crockett	58	319	605.13 (538.72-671.54)
Obion	59	709	603.96 (559.5-648.42)
Wayne	60	322	601.23 (535.56-666.9)
Dickson	61	908	591.82 (553.32-630.31)
Bedford	62	783	589.45 (548.16-630.74)
Macon	63	1042	588.33 (552.61-624.06)
Jefferson	64	915	585.44 (547.51-623.37)
Knox	65	8103	584.80 (572.07-597.54)
Hardin	66	530	582.55 (532.95-632.14)
Dyer	67	791	582.32 (541.74-622.91)
Tipton	68	1052	580.59 (545.51-615.67)
Blount	69	2212	580.08 (555.9-604.25)
Sevier	70	1451	574.80 (545.22-604.38)
Davidson	71	11727	567.47 (557.2-577.74)
Shelby	72	18606	566.47 (558.33-574.61)
Marion	73	396	551.95 (497.58-606.31)
Lewis	74	220	545.01 (472.99-617.03)
Weakley	75	677	539.87 (499.2-580.54)
Van Buren	76	103	531.72 (429.03-634.41)
Chester	77	293	525.42 (465.26-585.58)
Hawkins	78	999	521.77 (489.41-554.12)
Pickett	79	91	518.96 (417.84-637.17)
Carter	80	1053	517.95 (486.66-549.23)
Cheatham	81	647	517.12 (477.28-556.97)
Hancock	82	126	517.01 (426.73-607.28)
Bradley	83	1551	491.66 (467.19-516.13)
Sumner	84	2265	486.69 (466.65-506.74)
Wilson	85	1512	482.42 (458.1-506.74)
Bledsoe	86	183	472.77 (404.27-541.27)
Johnson	87	265	464.04 (408.17-519.91)
Montgomery	88	2157	461.74 (442.26-481.23)
Fayette	89	470	461.08 (419.39-502.76)
Sequatchie	90	181	454.49 (388.28-520.7)
Union	91	283	452.61 (399.88-505.35)
Williamson	92	1977	443.90 (424.33-463.47)
Lincoln	93	477	422.57 (384.65-460.49)
Rutherford	94	2645	415.48 (399.65-431.32)
Moore	95	62	307.27 (235.58-393.9)
Tennessee		121560	595.36 (592.02-598.71)

Female In-Patient Cases Ranked by Mean Rate



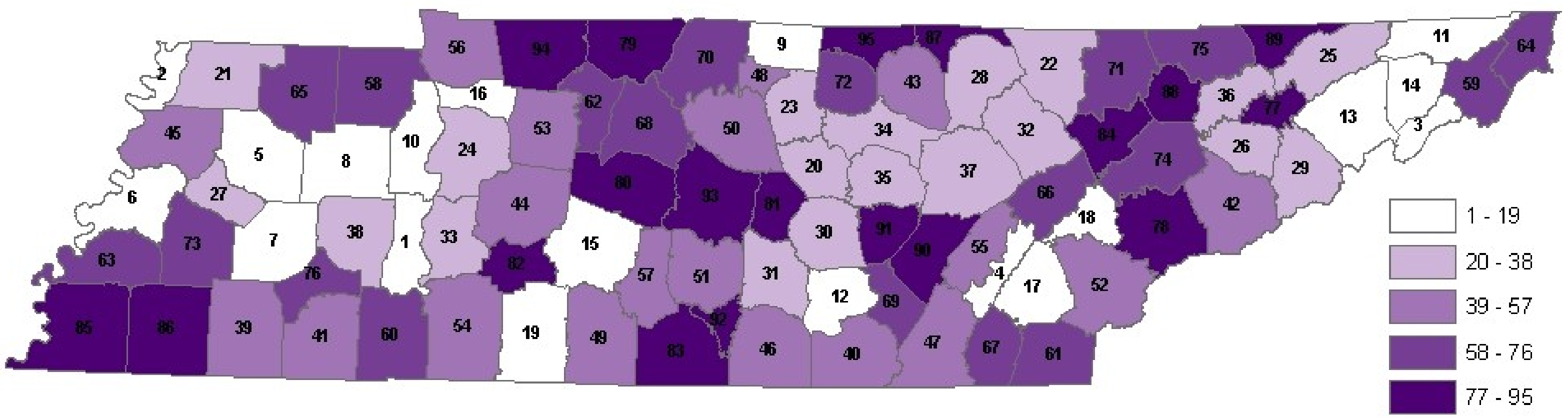
ALL CANCERS FEMALE IN-PATIENTS 1997-2003, Ranked by Mean Rates

County	Rank	Number	Mean Rate
Decatur	1	405	961.06 (867.46-1054.66)
Fentress	2	518	875.13 (799.77-950.5)
Gibson	3	1558	874.46 (831.04-917.89)
Unicoi	4	532	840.01 (768.63-911.39)
Grundy	5	427	835.15 (755.93-914.36)
Morgan	6	526	816.52 (746.74-886.3)
Carroll	7	874	815.13 (761.09-869.17)
Henry	8	912	812.43 (759.7-865.16)
Perry	9	215	801.75 (694.58-908.92)
Loudon	10	1124	801.01 (754.18-847.84)
Houston	11	230	800.40 (696.96-903.85)
Claiborne	12	857	794.55 (741.35-847.74)
Meigs	13	296	771.26 (683.4-859.13)
Lauderdale	14	702	766.63 (709.92-823.34)
Stewart	15	328	760.55 (678.24-842.86)
Overton	16	539	755.40 (691.62-819.17)
Cumberland	17	1263	752.99 (711.47-794.52)
Trousdale	18	192	750.71 (644.52-856.89)
DeKalb	19	458	743.80 (675.68-811.92)
Benton	20	442	740.86 (671.79-809.93)
Madison	21	655	740.67 (683.95-797.4)
Lake	22	165	739.17 (626.39-851.96)
Scott	23	547	730.47 (669.26-791.69)
Campbell	24	1027	712.66 (669.08-756.25)
Lawrence	25	1008	700.22 (657-743.45)
Smith	26	432	694.15 (628.69-759.6)
Hamblen	27	1426	689.90 (654.09-725.71)
McNairy	28	1697	676.44 (644.26-708.63)
Coffee	29	1158	672.84 (634.08-711.59)
McMinn	30	645	672.81 (620.88-724.73)
Putnam	31	1480	671.64 (637.42-705.86)
Maury	32	655	662.45 (611.72-713.18)

County	Rank	Number	Mean Rate
Polk	33	372	661.73 (594.48-728.97)
Giles	34	699	661.45 (612.41-710.49)
Hardeman	35	603	660.50 (607.78-713.22)
Cannon	36	299	659.57 (584.81-734.34)
Roane	37	1232	657.24 (620.54-693.94)
White	38	542	656.12 (600.88-711.36)
Warren	39	889	653.13 (610.19-696.06)
Washington	40	2508	651.59 (626.09-677.1)
Anderson	41	1702	649.68 (618.81-680.54)
Clay	42	184	644.06 (551-737.12)
Humphreys	43	408	640.93 (578.74-703.12)
Haywood	44	472	638.49 (580.88-696.09)
Monroe	45	872	636.83 (594.57-679.1)
Cocke	46	767	636.14 (591.12-681.16)
Greene	47	1416	630.72 (597.86-663.57)
Sullivan	48	3491	629.13 (608.26-650)
Marshall	49	2090	627.60 (600.69-654.51)
Franklin	50	881	625.19 (583.9-666.47)
Robertson	51	1193	623.50 (588.12-658.88)
Hamilton	52	6998	622.43 (607.84-637.01)
Hickman	53	453	620.84 (563.67-678.01)
Jackson	54	235	608.93 (531.08-686.79)
Henderson	55	559	608.13 (557.72-658.54)
Crockett	56	319	605.95 (539.45-672.44)
Rhea	57	620	605.92 (558.23-653.62)
Obion	58	709	604.01 (559.55-648.47)
Grainger	59	438	603.74 (547.2-660.28)
Wayne	60	322	600.93 (535.29-666.57)
Dickson	61	908	592.65 (554.1-631.2)
Bedford	62	783	588.45 (547.23-629.66)
Macon	63	1042	588.27 (552.55-623.99)
Jefferson	64	915	585.52 (547.58-623.46)

County	Rank	Number	Mean Rate
Knox	65	8103	585.05 (572.32-597.79)
Dyer	66	791	582.59 (541.99-623.19)
Hardin	67	530	582.32 (532.74-631.9)
Tipton	68	1052	580.49 (545.41-615.57)
Blount	69	2212	579.09 (554.96-603.22)
Sevier	70	1451	575.29 (545.69-604.89)
Davidson	71	11727	567.62 (557.35-577.9)
Shelby	72	18606	566.63 (558.49-574.77)
Marion	73	396	551.70 (497.37-606.04)
Lewis	74	220	544.78 (472.79-616.76)
Weakley	75	677	540.45 (499.74-581.16)
Van Buren	76	103	531.02 (428.47-633.57)
Chester	77	293	526.35 (466.08-586.62)
Hawkins	78	999	521.55 (489.2-553.89)
Pickett	79	91	519.39 (418.18-637.69)
Carter	80	1053	517.75 (486.47-549.02)
Cheatham	81	647	517.74 (477.84-557.63)
Hancock	82	126	517.19 (426.88-607.5)
Bradley	83	1551	491.74 (467.27-516.21)
Sumner	84	2265	485.46 (465.47-505.46)
Wilson	85	1512	482.40 (458.08-506.71)
Bledsoe	86	183	473.68 (405.05-542.31)
Johnson	87	265	463.42 (407.62-519.22)
Fayette	88	470	461.68 (419.94-503.41)
Montgomery	89	2157	461.65 (442.16-481.13)
Sequatchie	90	181	455.10 (388.8-521.4)
Union	91	283	453.69 (400.83-506.55)
Williamson	92	1977	445.37 (425.73-465)
Lincoln	93	477	422.36 (384.46-460.26)
Rutherford	94	2645	415.79 (399.94-431.63)
Moore	95	62	308.42 (236.47-395.38)
Tennessee		121560	595.55 (592.2-598.9)

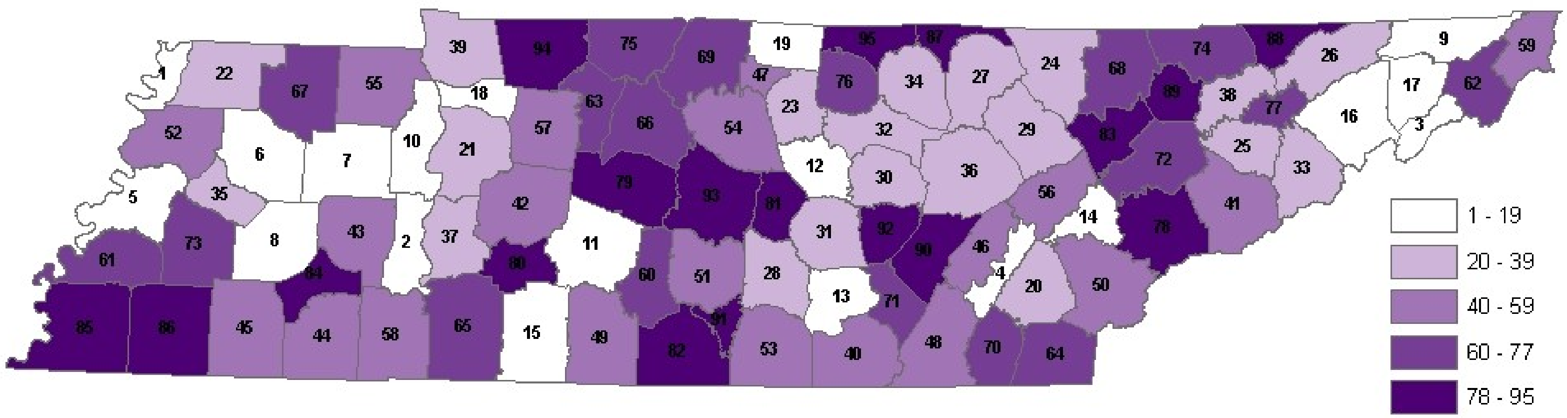
Female Out-Patient Cases Ranked by Crude Rate



ALL CANCERS FEMALE OUT-PATIENTS 1998-2003, Ranked by Crude Rates

County	Rank	Number	Crude Rate
Decatur	1	342	945.3 (845.11-1045.49)
Lake	2	180	945.18 (807.1-1083.26)
Unicoi	3	447	822.58 (746.33-898.84)
Meigs	4	264	794.27 (698.46-890.08)
Gibson	5	1165	763.18 (719.35-807)
Lauderdale	6	591	750.44 (689.94-810.94)
Madison	7	538	706.5 (646.8-766.2)
Carroll	8	647	701.73 (647.66-755.8)
Macon	9	1005	659.19 (618.43-699.94)
Benton	10	336	656.17 (586.01-726.34)
Sullivan	11	3107	652.95 (629.99-675.91)
Grundy	12	286	651.41 (575.91-726.9)
Greene	13	1260	650.87 (614.93-686.81)
Washington	14	2157	650.37 (622.92-677.82)
Maury	15	549	645.67 (591.66-699.68)
Houston	16	159	644.69 (544.48-744.9)
McMinn	17	533	644.26 (589.57-698.96)
Loudon	18	780	643.93 (598.74-689.12)
Lawrence	19	789	637.78 (593.28-682.28)
DeKalb	20	338	636.27 (568.44-704.1)
Obion	21	630	625.63 (576.77-674.48)
Scott	22	401	620.82 (560.06-681.58)
Smith	23	330	611.9 (545.88-677.93)
Humphreys	24	334	609.73 (544.34-675.13)
Hawkins	25	1008	609.63 (572-647.27)
Jefferson	26	814	601.37 (560.06-642.68)
Crockett	27	267	589.25 (518.57-659.93)
Fentress	28	300	588.3 (521.73-654.88)
Cocke	29	610	587.5 (540.88-634.12)
Warren	30	684	583.61 (539.87-627.34)
Coffee	31	855	576.58 (537.93-615.23)
Morgan	32	319	574.76 (511.69-637.84)
Perry	33	132	573.24 (475.45-671.03)
Putnam	34	1068	563.06 (529.29-596.83)
White	35	397	559.53 (504.49-614.57)
Grainger	36	349	558.53 (499.93-617.12)
Cumberland	37	804	553.85 (515.56-592.13)
Henderson	38	438	551.64 (499.98-603.3)
Hardeman	39	432	550.09 (498.21-601.96)
Marion	40	340	547.93 (489.69-606.17)
McNairy	41	1178	544.72 (513.61-575.83)
Sevier	42	1190	543.5 (512.62-574.38)
Overton	43	334	542.75 (484.54-600.95)
Hickman	44	342	541.13 (483.78-598.48)
Dyer	45	627	537.41 (495.35-579.48)
Franklin	46	651	536.3 (495.1-577.5)
Hamilton	47	5144	533.31 (518.73-547.88)
Trousdale	48	117	529.51 (433.56-625.46)
Giles	49	481	529.23 (481.94-576.53)
Wilson	50	1435	527.88 (500.57-555.2)
Bedford	51	605	527.87 (485.8-569.93)
Monroe	52	621	522.97 (481.84-564.11)
Dickson	53	686	517.28 (478.57-555.99)
Wayne	54	235	512.09 (446.62-577.57)
Rhea	55	450	511.57 (464.31-558.84)
Stewart	56	191	511.39 (438.87-583.92)
Marshall	57	1467	510.78 (484.64-536.92)
Henry	58	487	504.72 (459.89-549.55)
Carter	59	876	501.22 (468.03-534.41)
Hardin	60	391	500.04 (450.48-549.61)
Polk	61	241	496.9 (434.16-559.63)
Cheatham	62	533	492.49 (450.68-534.3)
Tipton	63	768	488.89 (454.31-523.46)
Johnson	64	240	488.48 (426.68-550.28)
Weakley	65	521	483.5 (441.98-525.02)
Roane	66	769	477.49 (443.75-511.24)
Bradley	67	1293	475.6 (449.67-501.52)
Davidson	68	8422	475.12 (464.97-485.26)
Sequatchie	69	163	471.71 (399.3-544.13)
Sumner	70	1856	461.5 (440.51-482.5)
Campbell	71	570	459.68 (421.94-497.41)
Jackson	72	151	452.77 (380.56-524.99)
Haywood	73	284	448.93 (396.71-501.14)
Knox	74	5314	446.49 (434.48-458.49)
Claiborne	75	415	446.3 (403.36-489.24)
Chester	76	213	442.74 (383.28-502.19)
Hamblen	77	779	438.74 (407.93-469.55)
Blount	78	1435	436.05 (413.49-458.62)
Robertson	79	721	435.08 (403.32-466.84)
Williamson	80	1675	430.54 (409.92-451.15)
Cannon	81	168	428.32 (363.55-493.09)
Lewis	82	147	422.97 (354.6-491.35)
Lincoln	83	389	400.13 (360.36-439.89)
Anderson	84	866	385.89 (360.19-411.59)
Shelby	85	10796	382.4 (375.19-389.62)
Fayette	86	318	360.45 (320.84-400.07)
Pickett	87	53	350.95 (262.88-459.05)
Union	88	188	347.27 (297.63-396.91)
Hancock	89	72	344.91 (269.87-434.36)
Bledsoe	90	113	337.27 (275.09-399.46)
Van Buren	91	54	324.83 (244.02-423.83)
Moore	92	56	322.23 (243.41-418.44)
Rutherford	93	1781	321.66 (306.72-336.6)
Montgomery	94	1285	317.94 (300.56-335.33)
Clay	95	77	313.66 (247.53-392.02)
Tennessee		86433	491.57 (488.29-494.84)

Female Out-Patient Cases Ranked by Mean Rate



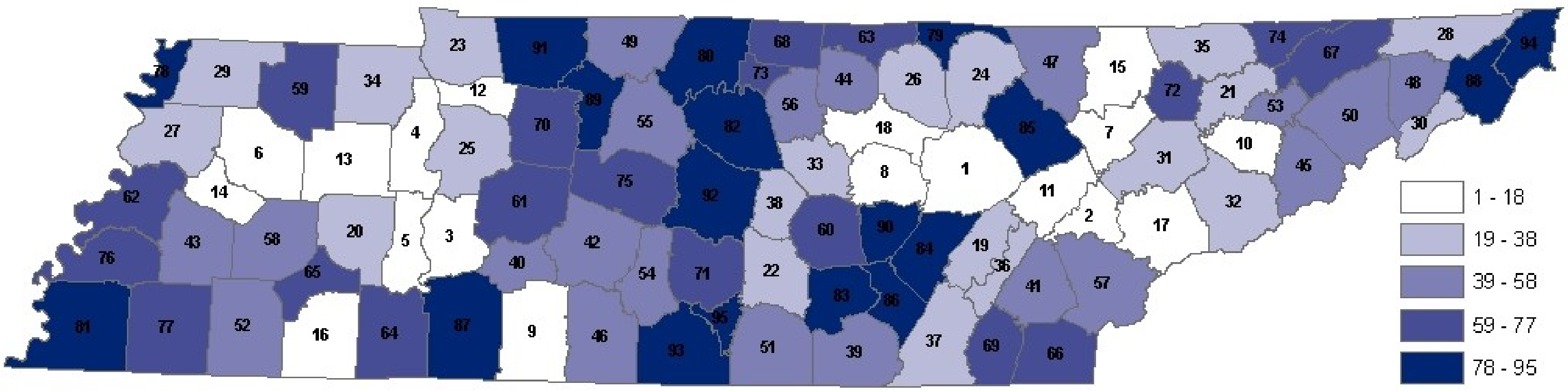
ALL CANCERS FEMALE OUT-PATIENTS 1998-2003, Ranked by Mean Rates

County	Rank	Number	Mean Rate
Lake	1	180	945.75 (807.59-1083.92)
Decatur	2	342	818.35 (731.62-905.09)
Unicoi	3	447	706.46 (640.97-771.95)
Meigs	4	264	701.66 (617.02-786.3)
Lauderdale	5	591	662.54 (609.13-715.96)
Gibson	6	1165	641.39 (604.55-678.22)
Carroll	7	647	613.71 (566.42-661)
Madison	8	538	595.71 (545.37-646.05)
Sullivan	9	3107	576.04 (555.78-596.29)
Benton	10	336	574.10 (512.71-635.49)
Maury	11	549	573.70 (525.71-621.69)
DeKalb	12	338	572.17 (511.17-633.17)
Grundy	13	286	571.11 (504.92-637.3)
Loudon	14	780	567.60 (527.76-607.43)
Lawrence	15	789	564.42 (525.04-603.8)
Greene	16	1260	562.13 (531.09-593.17)
Washington	17	2157	560.86 (537.19-584.53)
Houston	18	159	551.64 (465.89-637.38)
Macon	19	1005	550.20 (516.19-584.22)
McMinn	20	533	548.37 (501.81-594.92)
Humphreys	21	334	541.71 (483.62-599.81)
Obion	22	630	538.26 (496.23-580.29)
Smith	23	330	537.05 (479.11-595)
Scott	24	401	533.18 (480.99-585.36)
Jefferson	25	814	527.27 (491.05-563.5)
Hawkins	26	1008	525.57 (493.13-558.02)
Fentress	27	300	524.13 (464.82-583.44)
Coffee	28	855	519.78 (484.94-554.62)
Morgan	29	319	517.71 (460.89-574.52)
White	30	397	504.87 (455.21-554.53)
Warren	31	684	504.25 (466.46-542.04)
Putnam	32	1068	501.65 (471.56-531.73)

County	Rank	Number	Mean Rate
Cocke	33	610	500.26 (460.56-539.96)
Overton	34	334	497.17 (443.85-550.49)
Crockett	35	267	496.29 (436.76-555.83)
Cumberland	36	804	494.96 (460.75-529.17)
Perry	37	132	490.80 (407.07-574.53)
Grainger	38	349	479.92 (429.57-530.27)
Stewart	39	191	479.39 (411.41-547.38)
Marion	40	340	479.15 (428.21-530.08)
Sevier	41	1190	475.83 (448.79-502.87)
Hickman	42	342	475.57 (425.16-525.97)
Henderson	43	438	473.13 (428.82-517.44)
McNairy	44	1178	471.82 (444.87-498.76)
Hardeman	45	432	471.44 (426.98-515.89)
Rhea	46	450	470.65 (427.16-514.13)
Trousdale	47	117	469.99 (384.83-555.16)
Hamilton	48	5144	467.72 (454.93-480.5)
Giles	49	481	466.17 (424.51-507.83)
Monroe	50	621	464.03 (427.53-500.53)
Bedford	51	605	461.90 (425.1-498.71)
Dyer	52	627	460.92 (424.84-497)
Franklin	53	651	457.88 (422.7-493.05)
Wilson	54	1435	457.41 (433.75-481.08)
Henry	55	487	455.80 (415.32-496.28)
Roane	56	769	445.66 (414.16-477.15)
Dickson	57	686	443.41 (410.23-476.59)
Hardin	58	391	441.58 (397.81-485.35)
Johnson	59	240	440.55 (384.81-496.28)
Marshall	60	1467	438.04 (415.62-460.45)
Tipton	61	768	436.41 (405.55-467.28)
Carter	62	876	436.29 (407.4-465.18)
Cheatham	63	533	432.71 (395.98-469.45)
Polk	64	241	430.90 (376.49-485.3)

County	Rank	Number	Mean Rate
Wayne	65	235	430.61 (375.55-485.67)
Davidson	66	8422	422.94 (413.91-431.98)
Weakley	67	521	416.73 (380.94-452.51)
Campbell	68	570	413.51 (379.56-447.46)
Sumner	69	1856	410.00 (391.35-428.66)
Bradley	70	1293	407.25 (385.05-429.45)
Sequatchie	71	163	406.39 (344.01-468.78)
Knox	72	5314	395.59 (384.95-406.23)
Haywood	73	284	390.46 (345.04-435.87)
Claiborne	74	415	386.79 (349.58-424.01)
Robertson	75	721	386.44 (358.23-414.64)
Jackson	76	151	380.11 (319.48-440.74)
Hamblen	77	779	379.82 (353.15-406.5)
Blount	78	1435	379.60 (359.96-399.24)
Williamson	79	1675	379.58 (361.4-397.76)
Lewis	80	147	376.51 (315.64-437.38)
Cannon	81	168	372.36 (316.05-428.67)
Lincoln	82	389	360.64 (324.8-396.48)
Anderson	83	866	350.52 (327.17-373.86)
Chester	84	213	349.49 (302.55-396.42)
Shelby	85	10796	331.57 (325.32-337.83)
Fayette	86	318	331.40 (294.98-367.83)
Pickett	87	53	324.15 (242.81-423.99)
Hancock	88	72	316.06 (247.3-398.02)
Union	89	188	303.86 (260.43-347.3)
Bledsoe	90	113	298.59 (243.54-353.65)
Moore	91	56	287.88 (217.46-373.83)
Van Buren	92	54	287.78 (216.19-375.49)
Rutherford	93	1781	286.80 (273.48-300.12)
Montgomery	94	1285	286.34 (270.68-301.99)
Clay	95	77	284.41 (224.45-355.47)
Tennessee		86433	431.05 (428.18-433.92)

Male TCRI Cases Ranked by Crude Rate



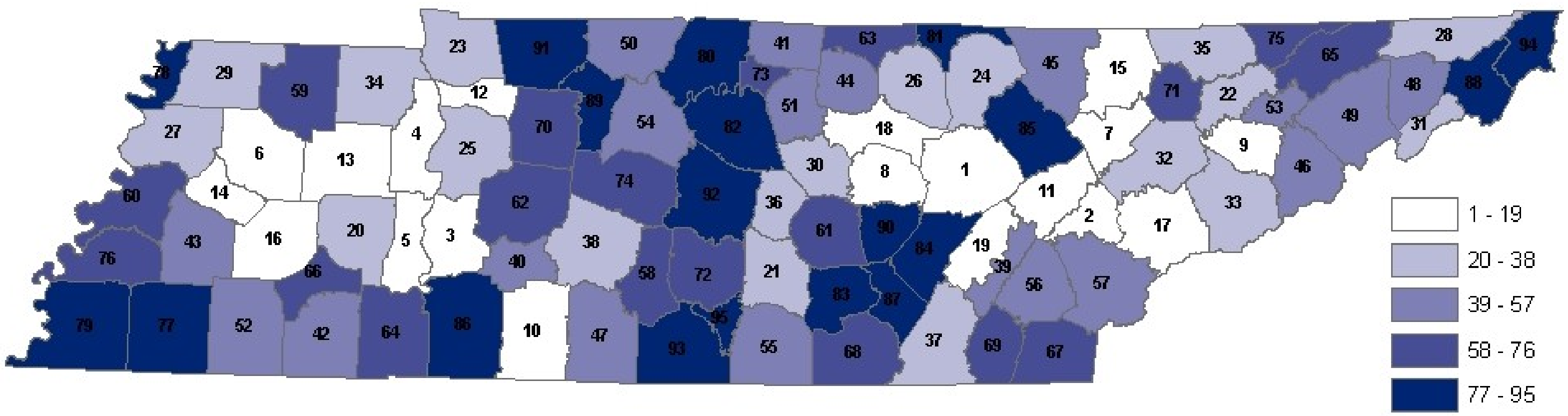
ALL CANCERS MALE TCRI CASES 1991-2000, Ranked by Crude Rates

County	Rank	Number	Crude Rate
Cumberland	1	1332	661.98 (626.43-697.53)
Loudon	2	1054	607.10 (570.45-643.75)
Perry	3	211	595.39 (515.05-675.73)
Benton	4	445	585.73 (531.31-640.15)
Decatur	5	301	556.93 (494.01-619.85)
Gibson	6	1240	553.92 (523.09-584.75)
Anderson	7	1828	539.47 (514.74-564.21)
White	8	566	535.90 (491.75-580.05)
Lawrence	9	977	528.61 (495.47-561.76)
Jefferson	10	1005	526.51 (493.96-559.06)
Roane	11	1265	522.75 (493.95-551.56)
Houston	12	196	516.41 (444.12-588.71)
Carroll	13	706	513.07 (475.22-550.92)
Crockett	14	340	510.68 (456.4-564.96)
Campbell	15	918	507.76 (474.91-540.61)
Madison	16	573	502.87 (461.69-544.04)
Blount	17	2353	498.30 (478.16-518.43)
Putnam	18	1397	489.19 (463.54-514.84)
Rhea	19	631	486.96 (448.97-524.96)
Henderson	20	549	482.78 (442.39-523.16)
Grainger	21	454	481.75 (437.43-526.06)
Coffee	22	1044	481.48 (452.28-510.69)
Stewart	23	262	479.12 (421.1-537.13)
Fentress	24	366	475.51 (426.79-524.23)
Humphreys	25	395	475.11 (428.26-521.97)
Overton	26	434	471.31 (426.97-515.66)
Dyer	27	807	468.92 (436.57-501.27)
Sullivan	28	3351	463.88 (448.17-479.58)
Obion	29	706	458.14 (424.34-491.93)
Unicoi	30	378	455.60 (409.67-501.53)
Knox	31	8032	455.08 (445.13-465.04)
Sevier	32	1377	452.43 (428.53-476.33)

County	Rank	Number	Crude Rate
DeKalb	33	352	452.24 (404.99-499.48)
Henry	34	645	449.79 (415.08-484.5)
Claiborne	35	615	448.79 (413.32-484.26)
Meigs	36	218	447.8 (388.36-507.25)
Hamilton	37	6381	447.40 (436.42-458.38)
Cannon	38	255	446.04 (391.29-500.78)
Maury	39	573	442.35 (406.13-478.57)
Lewis	40	229	440.57 (383.51-497.63)
Macon	41	958	432.34 (404.96-459.72)
McNairy	42	1343	431.34 (408.27-454.41)
Haywood	43	394	427.97 (385.71-470.23)
Jackson	44	212	427.66 (370.09-485.23)
Cocke	45	644	422.21 (389.6-454.82)
Giles	46	575	422.08 (387.58-456.58)
Scott	47	410	420.35 (379.66-461.04)
Washington	48	2050	418.31 (400.2-436.41)
Robertson	49	988	414.87 (389-440.74)
Greene	50	1194	414.36 (390.86-437.86)
Franklin	51	753	412.09 (382.65-441.52)
Hardeman	52	550	411.12 (376.76-445.48)
Hamblen	53	1098	410.87 (386.56-435.17)
McMinn	54	493	409.72 (373.55-445.89)
Davidson	55	10783	409.62 (401.89-417.35)
Smith	56	316	409.29 (364.16-454.42)
Monroe	57	691	406.44 (376.14-436.75)
Marshall	58	1655	403.90 (384.44-423.36)
Weakley	59	647	400.19 (369.35-431.03)
Warren	60	699	399.56 (369.94-429.18)
Hickman	61	412	399.03 (360.5-437.56)
Lauderdale	62	517	398.42 (364.08-432.77)
Clay	63	145	390.71 (327.11-454.3)
Hardin	64	464	387.36 (352.11-422.61)

County	Rank	Number	Crude Rate
Chester	65	263	382.40 (336.18-428.62)
Polk	66	281	381.44 (336.84-426.03)
Hawkins	67	921	381.32 (356.69-405.95)
Marion	68	332	373.35 (333.19-413.51)
Bradley	69	1464	369.84 (350.9-388.79)
Dickson	70	706	368.32 (341.15-395.49)
Bedford	71	618	365.54 (336.72-394.36)
Union	72	286	363.92 (321.75-406.1)
Trousdale	73	116	362.68 (296.68-428.68)
Hancock	74	120	361.32 (296.67-425.96)
Williamson	75	1844	358.14 (341.8-374.49)
Tipton	76	785	355.61 (330.73-380.49)
Fayette	77	452	351.17 (318.79-383.54)
Lake	78	162	348.27 (294.64-401.9)
Pickett	79	80	346.13 (274.46-430.78)
Sumner	80	2009	346.11 (330.97-361.24)
Shelby	81	14332	345.50 (339.84-351.15)
Wilson	82	1338	343.43 (325.03-361.83)
Grundy	83	221	326.56 (283.5-369.61)
Bledsoe	84	195	322.12 (276.91-367.33)
Morgan	85	317	318.15 (283.13-353.17)
Sequatchie	86	154	308.43 (259.72-357.15)
Wayne	87	264	306.94 (269.91-343.96)
Carter	88	809	306.04 (284.95-327.13)
Cheatham	89	488	304.00 (277.03-330.98)
Van Buren	90	74	280.11 (219.95-351.66)
Montgomery	91	1618	267.39 (254.36-280.42)
Rutherford	92	2022	265.46 (253.89-277.03)
Lincoln	93	366	254.60 (228.52-280.68)
Johnson	94	198	225.76 (194.32-257.21)
Moore	95	51	192.60 (143.4-253.23)
Tennessee		105638	407.59 (405.13-410.05)

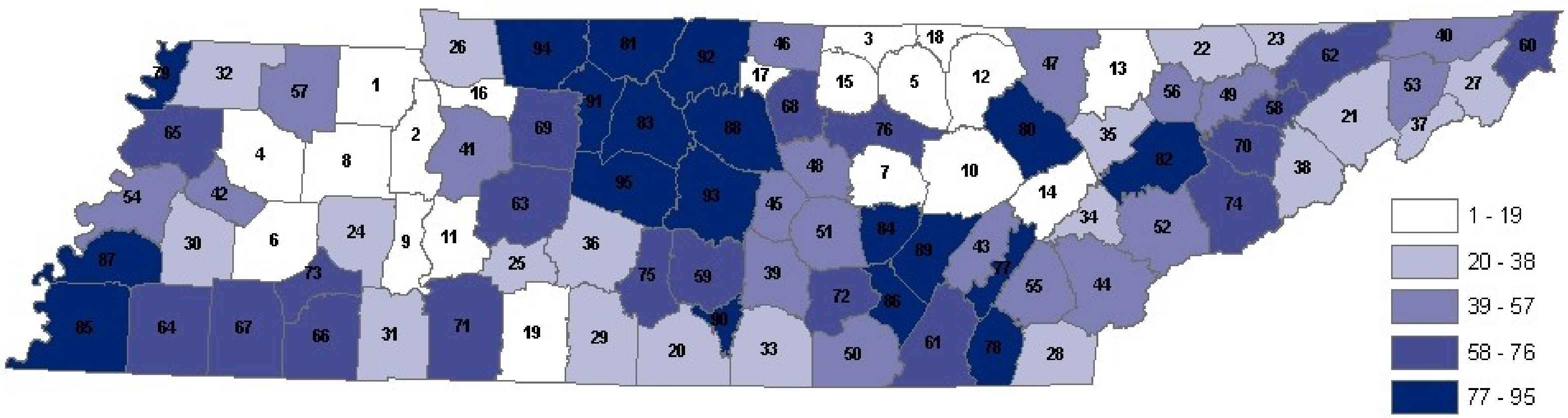
Males TCRI Cases Ranked by Mean Rate



ALL CANCERS MALE TCRI CASES 1991-2000, Ranked by Mean Rates

County	Rank	Number	Mean Rate
Cumberland	1	1332	655.58 (620.37-690.78)
Loudon	2	1054	606.40 (569.79-643.01)
Perry	3	211	594.57 (514.35-674.8)
Benton	4	445	587.63 (533.03-642.23)
Decatur	5	301	558.91 (495.77-622.06)
Gibson	6	1240	554.48 (523.62-585.34)
Anderson	7	1828	539.79 (515.04-564.53)
White	8	566	537.29 (493.02-581.55)
Jefferson	9	1005	526.44 (493.89-558.99)
Lawrence	10	977	526.39 (493.38-559.4)
Roane	11	1265	523.24 (494.4-552.07)
Houston	12	196	514.67 (442.62-586.73)
Carroll	13	706	513.36 (475.49-551.23)
Crockett	14	340	511.79 (457.39-566.19)
Campbell	15	918	507.92 (475.06-540.78)
Madison	16	573	504.16 (462.88-545.44)
Blount	17	2353	498.09 (477.97-518.22)
Putnam	18	1397	491.53 (465.76-517.31)
Rhea	19	631	488.15 (450.07-526.24)
Henderson	20	549	484.21 (443.71-524.72)
Coffee	21	1044	483.49 (454.16-512.82)
Grainger	22	454	482.53 (438.15-526.92)
Stewart	23	262	481.04 (422.79-539.29)
Fentress	24	366	474.83 (426.19-523.48)
Humphreys	25	395	473.18 (426.52-519.85)
Overton	26	434	470.86 (426.56-515.16)
Dyer	27	807	469.92 (437.5-502.35)
Sullivan	28	3351	463.64 (447.95-479.34)
Obion	29	706	457.99 (424.21-491.78)
DeKalb	30	352	456.96 (409.22-504.69)
Unicoi	31	378	456.26 (410.27-502.26)
Knox	32	8032	456.12 (446.15-466.1)
Sevier	33	1377	454.53 (430.52-478.54)
Henry	34	645	448.69 (414.07-483.32)
Claiborne	35	615	448.08 (412.67-483.5)
Cannon	36	255	447.35 (392.44-502.26)
Hamilton	37	6381	447.16 (436.19-458.13)
Maury	38	573	442.32 (406.1-478.54)
Meigs	39	218	441.62 (383-500.25)
Lewis	40	229	438.15 (381.4-494.9)
Macon	41	958	432.89 (405.47-460.3)
McNairy	42	1343	428.64 (405.72-451.57)
Haywood	43	394	428.13 (385.86-470.41)
Jackson	44	212	427.97 (370.36-485.58)
Scott	45	410	421.41 (380.62-462.21)
Cocke	46	644	420.23 (387.78-452.69)
Giles	47	575	420.09 (385.75-454.42)
Washington	48	2050	418.26 (400.16-436.37)
Greene	49	1194	414.62 (391.1-438.13)
Robertson	50	988	414.15 (388.32-439.97)
Smith	51	316	413.97 (368.33-459.62)
Hardeman	52	550	412.38 (377.91-446.84)
Hamblen	53	1098	411.31 (386.98-435.64)
Davidson	54	10783	410.56 (402.81-418.31)
Franklin	55	753	409.46 (380.22-438.71)
McMinn	56	493	407.95 (371.93-443.96)
Monroe	57	691	407.44 (377.06-437.82)
Marshall	58	1655	405.67 (386.12-425.21)
Weakley	59	647	401.47 (370.54-432.41)
Lauderdale	60	517	399.97 (365.49-434.45)
Warren	61	699	399.96 (370.3-429.61)
Hickman	62	412	395.39 (357.21-433.57)
Clay	63	145	391.95 (328.15-455.74)
Hardin	64	464	387.05 (351.83-422.27)
Hawkins	65	921	382.01 (357.34-406.69)
Chester	66	263	381.85 (335.7-428)
Polk	67	281	380.08 (335.64-424.52)
Marion	68	332	370.96 (331.06-410.87)
Bradley	69	1464	369.34 (350.42-388.26)
Dickson	70	706	366.75 (339.7-393.81)
Union	71	286	365.17 (322.85-407.5)
Bedford	72	618	364.49 (335.76-393.23)
Trousdale	73	116	362.55 (296.57-428.53)
Williamson	74	1844	362.31 (345.78-378.85)
Hancock	75	120	360.81 (296.25-425.36)
Tipton	76	785	355.4 (330.54-380.27)
Fayette	77	452	349.78 (317.53-382.03)
Lake	78	162	349.19 (295.42-402.97)
Shelby	79	14332	345.49 (339.83-351.14)
Sumner	80	2009	345.28 (330.18-360.37)
Pickett	81	80	344.75 (273.37-429.07)
Wilson	82	1338	344.41 (325.95-362.86)
Grundy	83	221	326.14 (283.14-369.14)
Bledsoe	84	195	323.55 (278.14-368.96)
Morgan	85	317	320.03 (284.8-355.26)
Wayne	86	264	308.25 (271.06-345.43)
Sequatchie	87	154	306.46 (258.06-354.86)
Carter	88	809	305.56 (284.5-326.62)
Cheatham	89	488	305.27 (278.18-332.35)
Van Buren	90	74	280.90 (220.57-352.64)
Montgomery	91	1618	266.64 (253.65-279.63)
Rutherford	92	2022	262.85 (251.39-274.3)
Lincoln	93	366	253.62 (227.64-279.6)
Johnson	94	198	226.23 (194.72-257.74)
Moore	95	51	190.93 (142.16-251.04)
Tennessee		105638	407.79 (405.33-410.25)

Male Death Certificate Cases Ranked by Crude Rate



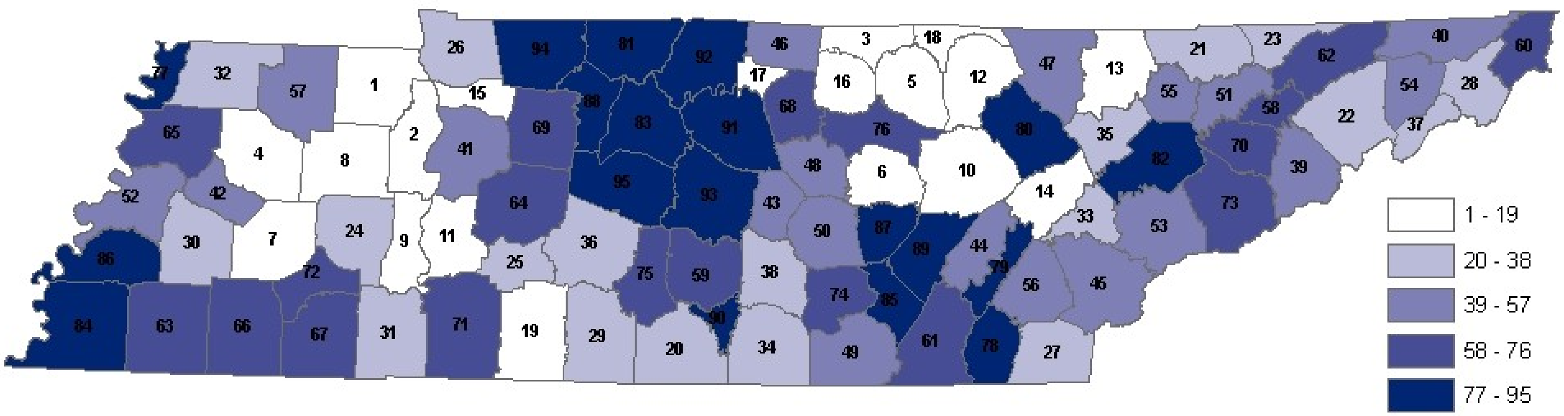
ALL CANCERS MALE DEATHS 1990-2003, Ranked by Crude Rates

County	Rank	Number	Crude Rate
Henry	1	731	361.35 (335.16-387.55)
Benton	2	385	359.50 (323.59-395.41)
Clay	3	185	353.50 (302.56-404.44)
Gibson	4	1056	336.12 (315.85-356.4)
Overton	5	436	333.92 (302.58-365.26)
Madison	6	536	333.10 (304.9-361.3)
White	7	498	332.41 (303.22-361.61)
Carroll	8	643	332.16 (306.49-357.84)
Decatur	9	250	327.88 (287.24-368.53)
Cumberland	10	939	326.04 (305.19-346.9)
Perry	11	163	325.32 (275.38-375.27)
Fentress	12	342	313.85 (280.59-347.11)
Campbell	13	795	310.83 (289.22-332.43)
Roane	14	1053	308.79 (290.14-327.44)
Jackson	15	218	308.33 (267.4-349.26)
Houston	16	164	307.00 (260.01-353.98)
Trousdale	17	139	303.79 (253.28-354.29)
Pickett	18	99	302.36 (245.75-368.12)
Lawrence	19	787	301.79 (280.7-322.87)
Lincoln	20	608	298.70 (274.96-322.45)
Greene	21	1217	298.03 (281.29-314.78)
Claiborne	22	576	297.71 (273.39-322.02)
Hancock	23	138	296.86 (247.33-346.39)
Henderson	24	478	295.60 (269.1-322.1)
Lewis	25	216	293.43 (254.3-332.57)
Stewart	26	229	292.31 (254.45-330.17)
Carter	27	1081	290.26 (272.96-307.56)
Polk	28	303	290.01 (257.36-322.67)
Giles	29	556	289.52 (265.45-313.58)
Haywood	30	373	289.38 (260.01-318.75)
Hardin	31	489	289.22 (263.58-314.85)
Obion	32	625	288.56 (265.94-311.19)

County	Rank	Number	Crude Rate
Franklin	33	743	288.01 (267.3-308.72)
Loudon	34	712	287.91 (266.76-309.06)
Anderson	35	1359	286.96 (271.7-302.21)
Maury	36	524	286.79 (262.23-311.34)
Unicoi	37	334	285.72 (255.08-316.36)
Cocke	38	616	284.70 (262.22-307.19)
Coffee	39	875	284.10 (265.28-302.93)
Sullivan	40	2872	283.37 (273-293.73)
Humphreys	41	332	282.22 (251.86-312.58)
Crockett	42	264	279.91 (246.14-313.68)
Rhea	43	508	277.15 (253.05-301.25)
Monroe	44	676	276.93 (256.05-297.8)
Cannon	45	225	276.19 (240.1-312.28)
Macon	46	862	274.43 (256.11-292.75)
Scott	47	376	271.54 (244.1-298.99)
DeKalb	48	297	267.18 (236.8-297.57)
Grainger	49	358	266.62 (239.01-294.24)
Marion	50	339	265.76 (237.47-294.05)
Warren	51	658	264.78 (244.55-285.02)
Blount	52	1766	263.29 (251.01-275.56)
Washington	53	1824	262.76 (250.7-274.82)
Lauderdale	54	483	262.08 (238.71-285.45)
McMinn	55	448	262.04 (237.77-286.3)
Union	56	294	260.59 (230.8-290.38)
Weakley	57	595	260.57 (239.63-281.5)
Hamblen	58	986	260.06 (243.82-276.29)
Bedford	59	617	255.11 (234.98-275.24)
Johnson	60	313	254.47 (226.28-282.67)
Hamilton	61	5037	251.12 (244.18-258.05)
Hawkins	62	859	250.69 (233.92-267.45)
Hickman	63	370	249.12 (223.74-274.51)
Fayette	64	460	248.67 (225.94-271.39)

County	Rank	Number	Crude Rate
Dyer	65	602	248.05 (228.23-267.87)
McNairy	66	1074	243.13 (228.59-257.68)
Hardeman	67	465	242.95 (220.86-265.03)
Smith	68	269	242.61 (213.61-271.6)
Dickson	69	662	241.8 (223.38-260.22)
Jefferson	70	664	241.73 (223.34-260.12)
Wayne	71	292	241.43 (213.74-269.12)
Grundy	72	230	240.76 (209.65-271.88)
Chester	73	236	240.56 (209.87-271.25)
Sevier	74	1052	240.51 (225.98-255.04)
Marshall	75	1372	236.13 (223.63-248.62)
Putnam	76	956	235.38 (220.46-250.3)
Meigs	77	163	233.84 (197.94-269.74)
Bradley	78	1302	231.30 (218.73-243.86)
Lake	79	149	230.29 (193.31-267.27)
Morgan	80	317	225.04 (200.27-249.81)
Robertson	81	761	222.10 (206.32-237.88)
Knox	82	5491	220.67 (214.84-226.51)
Davidson	83	7987	214.79 (210.08-219.5)
Van Buren	84	79	212.71 (168.4-265.1)
Shelby	85	12359	211.45 (207.72-215.17)
Sequatchie	86	151	210.71 (177.1-244.31)
Tipton	87	663	208.89 (192.99-224.79)
Wilson	88	1140	203.86 (192.03-215.69)
Bledsoe	89	176	203.64 (173.56-233.73)
Moore	90	76	202.95 (159.9-254.02)
Cheatham	91	465	202.40 (184-220.79)
Sumner	92	1596	192.61 (183.16-202.06)
Rutherford	93	1808	163.59 (156.05-171.13)
Montgomery	94	1361	157.18 (148.83-165.53)
Williamson	95	1099	146.23 (137.58-154.88)
Tennessee		88307	240.36 (238.78-241.95)

Male Death Certificate Cases Ranked by Mean Rate



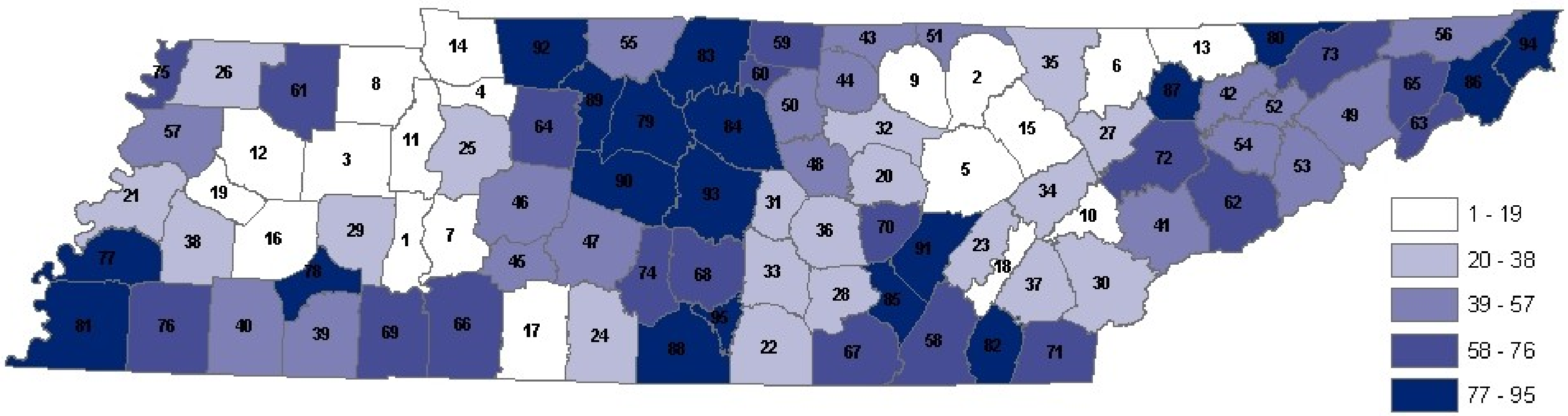
ALL CANCERS MALE DEATHS 1990-2003, Ranked by Mean Rates

County	Rank	Number	Mean Rate
Henry	1	731	360.82 (334.67-386.98)
Benton	2	385	360.61 (324.59-396.64)
Clay	3	185	354.51 (303.43-405.6)
Gibson	4	1056	336.10 (315.83-356.37)
Overton	5	436	333.58 (302.27-364.89)
White	6	498	332.92 (303.68-362.16)
Madison	7	536	332.89 (304.71-361.07)
Carroll	8	643	331.92 (306.27-357.58)
Decatur	9	250	328.07 (287.4-368.73)
Cumberland	10	939	325.40 (304.58-346.21)
Perry	11	163	324.15 (274.39-373.91)
Fentress	12	342	313.32 (280.11-346.53)
Campbell	13	795	310.19 (288.63-331.75)
Roane	14	1053	308.40 (289.77-327.03)
Houston	15	164	306.96 (259.98-353.94)
Jackson	16	218	305.80 (265.21-346.4)
Trousdale	17	139	303.79 (253.29-354.29)
Pickett	18	99	301.92 (245.39-367.58)
Lawrence	19	787	301.71 (280.63-322.79)
Lincoln	20	608	298.52 (274.79-322.25)
Claiborne	21	576	297.51 (273.22-321.81)
Greene	22	1217	296.99 (280.3-313.67)
Hancock	23	138	296.71 (247.2-346.21)
Henderson	24	478	295.46 (268.97-321.94)
Lewis	25	216	294.20 (254.97-333.43)
Stewart	26	229	292.57 (254.68-330.46)
Polk	27	303	291.50 (258.67-324.32)
Carter	28	1081	290.41 (273.1-307.72)
Giles	29	556	289.94 (265.84-314.05)
Haywood	30	373	289.48 (260.1-318.86)
Hardin	31	489	288.87 (263.26-314.47)
Obion	32	625	288.23 (265.63-310.83)

County	Rank	Number	Mean Rate
Loudon	33	712	287.98 (266.82-309.13)
Franklin	34	743	287.41 (266.75-308.08)
Anderson	35	1359	286.77 (271.52-302.01)
Maury	36	524	285.86 (261.39-310.34)
Unicoi	37	334	285.49 (254.87-316.1)
Coffee	38	875	284.48 (265.63-303.33)
Cocke	39	616	283.55 (261.15-305.94)
Sullivan	40	2872	283.01 (272.66-293.36)
Humphreys	41	332	281.19 (250.94-311.43)
Crockett	42	264	280.62 (246.77-314.48)
Cannon	43	225	277.68 (241.4-313.96)
Rhea	44	508	277.31 (253.2-301.43)
Monroe	45	676	277.18 (256.29-298.08)
Macon	46	862	273.74 (255.47-292.01)
Scott	47	376	272.61 (245.06-300.17)
DeKalb	48	297	270.53 (239.76-301.3)
Marion	49	339	268.41 (239.84-296.98)
Warren	50	658	266.42 (246.06-286.78)
Grainger	51	358	265.43 (237.93-292.92)
Lauderdale	52	483	264.10 (240.55-287.65)
Blount	53	1766	262.73 (250.48-274.98)
Washington	54	1824	262.51 (250.46-274.55)
Union	55	294	262.01 (232.06-291.96)
McMinn	56	448	261.76 (237.52-286)
Weakley	57	595	260.99 (240.02-281.96)
Hamblen	58	986	259.83 (243.61-276.05)
Bedford	59	617	255.80 (235.62-275.99)
Johnson	60	313	253.24 (225.19-281.3)
Hamilton	61	5037	251.15 (244.21-258.09)
Hawkins	62	859	250.49 (233.74-267.24)
Fayette	63	460	249.20 (226.43-271.98)
Hickman	64	370	248.59 (223.26-273.93)

County	Rank	Number	Mean Rate
Dyer	65	602	248.37 (228.53-268.21)
Hardeman	66	465	245.11 (222.83-267.39)
McNairy	67	1074	244.73 (230.09-259.36)
Smith	68	269	244.59 (215.36-273.81)
Dickson	69	662	243.95 (225.37-262.54)
Jefferson	70	664	243.02 (224.53-261.5)
Wayne	71	292	242.64 (214.81-270.47)
Chester	72	236	239.78 (209.18-270.37)
Sevier	73	1052	239.70 (225.22-254.19)
Grundy	74	230	239.64 (208.67-270.61)
Marshall	75	1372	237.37 (224.81-249.93)
Putnam	76	956	235.32 (220.4-250.24)
Lake	77	149	233.08 (195.65-270.5)
Bradley	78	1302	231.89 (219.3-244.49)
Meigs	79	163	230.21 (194.87-265.56)
Morgan	80	317	226.16 (201.27-251.06)
Robertson	81	761	224.01 (208.09-239.92)
Knox	82	5491	220.98 (215.13-226.82)
Davidson	83	7987	215.14 (210.42-219.86)
Shelby	84	12359	211.81 (208.08-215.55)
Sequatchie	85	151	211.27 (177.57-244.97)
Tipton	86	663	209.81 (193.84-225.78)
Van Buren	87	79	209.56 (165.91-261.17)
Cheatham	88	465	204.39 (185.81-222.97)
Bledsoe	89	176	204.18 (174.01-234.35)
Moore	90	76	202.83 (159.81-253.88)
Wilson	91	1140	202.26 (190.52-214)
Sumner	92	1596	191.88 (182.47-201.3)
Rutherford	93	1808	164.86 (157.26-172.46)
Montgomery	94	1361	157.54 (149.17-165.9)
Williamson	95	1099	146.38 (137.73-155.04)
Tennessee		88307	240.59 (239-242.17)

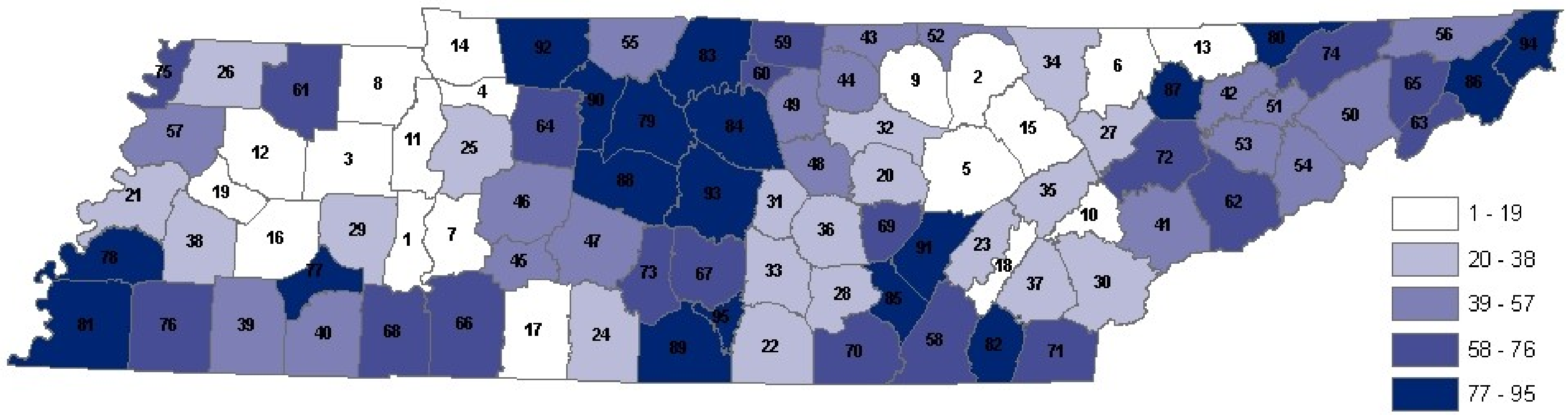
Male In-Patient Cases Ranked by Crude Rate



ALL CANCERS MALE IN-PATIENTS 1997-2003, Ranked by Crude Rates

County	Rank	Number	Crude Rate
Decatur	1	432	1089.09 (986.39-1191.8)
Fentress	2	607	1066.84 (981.97-1151.71)
Carroll	3	1015	1026.05 (962.93-1089.17)
Houston	4	287	1025.07 (906.48-1143.67)
Cumberland	5	1589	1006.89 (957.39-1056.4)
Campbell	6	1310	979.89 (926.82-1032.95)
Perry	7	254	962.27 (843.93-1080.61)
Henry	8	1003	957.73 (898.46-1017)
Overton	9	649	947.43 (874.54-1020.32)
Loudon	10	1235	928.94 (877.13-980.75)
Benton	11	510	911.82 (832.68-990.96)
Gibson	12	1441	903.79 (857.13-950.46)
Claiborne	13	887	882.17 (824.12-940.23)
Stewart	14	368	861.97 (773.9-950.04)
Morgan	15	624	847.22 (780.74-913.69)
Madison	16	702	844.46 (781.99-906.93)
Lawrence	17	1129	832.75 (784.17-881.33)
Meigs	18	318	826.62 (735.76-917.47)
Crockett	19	404	826.01 (745.46-906.55)
White	20	646	817.28 (754.25-880.3)
Lauderdale	21	794	808.89 (752.63-865.16)
Franklin	22	1068	799.54 (751.59-847.49)
Rhea	23	764	793.37 (737.11-849.63)
Giles	24	785	785.98 (731-840.97)
Humphreys	25	483	784.98 (714.98-854.99)
Obion	26	858	783.21 (730.8-835.62)
Anderson	27	1839	771.61 (736.34-806.88)
Grundy	28	380	771.59 (694.01-849.17)
Henderson	29	656	767.34 (708.62-826.06)
Monroe	30	1017	765.93 (718.85-813)
Cannon	31	332	762.18 (680.2-844.17)
Putnam	32	1642	758.42 (721.74-795.11)
Coffee	33	1226	751 (708.96-793.04)
Roane	34	1319	749.37 (708.93-789.81)
Scott	35	545	748.05 (685.25-810.86)
Warren	36	975	743.41 (696.74-790.07)
McMinn	37	674	738.49 (682.74-794.25)
Haywood	38	474	731.50 (665.65-797.36)
McNairy	39	1731	731.31 (696.85-765.76)
Hardeman	40	763	730.58 (678.74-782.42)
Blount	41	2607	730.00 (701.98-758.03)
Grainger	42	521	727.35 (664.89-789.81)
Clay	43	195	724.21 (622.56-825.86)
Jackson	44	270	716.60 (631.12-802.08)
Lewis	45	280	715.20 (631.43-798.97)
Hickman	46	581	709.46 (651.77-767.15)
Maury	47	669	705.94 (652.45-759.44)
DeKalb	48	423	705.49 (638.26-772.73)
Greene	49	1502	704.64 (669.01-740.28)
Smith	50	424	703.55 (636.58-770.52)
Pickett	51	118	696.95 (571.19-822.7)
Hamblen	52	1392	696.92 (660.31-733.53)
Cocke	53	790	694.11 (645.71-742.51)
Jefferson	54	1054	693.22 (651.37-735.07)
Robertson	55	1301	690.71 (653.17-728.24)
Sullivan	56	3518	680.74 (658.24-703.23)
Dyer	57	844	676.40 (630.77-722.04)
Hamilton	58	6916	671.94 (656.1-687.77)
Macon	59	1089	660.07 (620.87-699.28)
Trousdale	60	162	657.65 (556.38-758.93)
Weakley	61	777	657.40 (611.17-703.62)
Sevier	62	1582	654.87 (622.6-687.14)
Unicoi	63	392	652.43 (587.84-717.02)
Dickson	64	948	643.10 (602.17-684.04)
Washington	65	2331	639.28 (613.33-665.23)
Wayne	66	413	637.79 (576.28-699.3)
Marion	67	443	637.03 (577.71-696.36)
Bedford	68	828	635.81 (592.5-679.12)
Hardin	69	559	635.26 (582.59-687.92)
Van Buren	70	122	634.95 (522.28-747.63)
Polk	89	349	632.26 (565.92-698.59)
Knox	71	8125	627.88 (614.23-641.53)
Hawkins	72	1130	624.11 (587.72-660.5)
Marshall	73	1912	623.68 (595.72-651.63)
Lake	74	205	608.53 (525.23-691.83)
Fayette	75	590	600.28 (551.84-648.72)
Tipton	76	1046	596.69 (560.53-632.85)
Chester	77	314	595.58 (529.7-661.45)
Davidson	78	11318	584.62 (573.85-595.39)
Hancock	79	135	581.80 (483.65-679.94)
Shelby	80	17320	577.53 (568.93-586.13)
Bradley	81	1651	550.92 (524.35-577.5)
Sumner	82	2440	546.91 (525.21-568.61)
Wilson	83	1624	532.30 (506.41-558.19)
Sequatchie	84	198	507.56 (436.86-578.26)
Carter	85	959	499.62 (468-531.25)
Union	86	305	494.54 (439.03-550.04)
Lincoln	87	519	490.27 (448.09-532.45)
Cheatham	88	615	490.21 (451.47-528.96)
Williamson	90	2113	489.93 (469.04-510.82)
Bledsoe	91	207	442.61 (382.31-502.91)
Montgomery	92	1896	401.48 (383.41-419.55)
Rutherford	93	2428	385.73 (370.39-401.07)
Johnson	94	234	358.18 (312.28-404.07)
Moore	95	58	293.85 (223.13-379.87)
Tennessee		124802	645.22 (641.64-648.8)

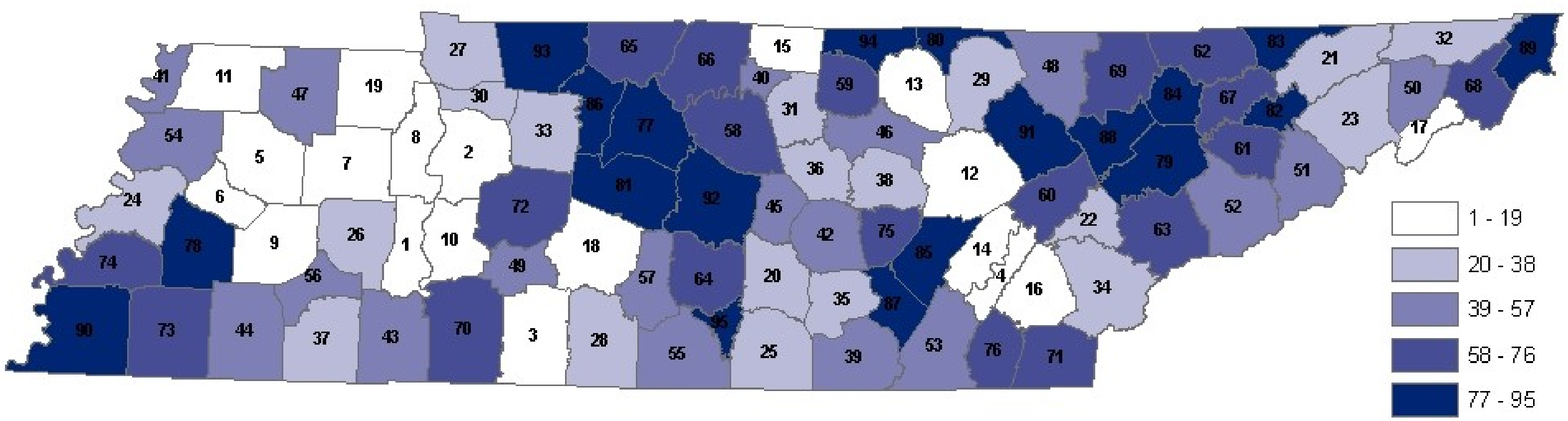
Male In-Patient Cases Ranked by Mean Rate



ALL CANCERS MALE IN-PATIENTS 1997-2003, Ranked by Mean Rates

County	Rank	Number	Mean Rate
Decatur	1	432	1088.23 (985.61-1190.85)
Fentress	2	607	1063.81 (979.18-1148.44)
Carroll	3	1015	1026.54 (963.39-1089.7)
Houston	4	287	1025.29 (906.67-1143.91)
Cumberland	5	1589	1006.19 (956.71-1055.66)
Campbell	6	1310	979.92 (926.85-1032.98)
Perry	7	254	962.14 (843.81-1080.46)
Henry	8	1003	957.02 (897.79-1016.25)
Overton	9	649	946.53 (873.7-1019.35)
Loudon	10	1235	930.47 (878.57-982.36)
Benton	11	510	911.68 (832.55-990.8)
Gibson	12	1441	903.97 (857.29-950.64)
Claiborne	13	887	881.17 (823.18-939.16)
Stewart	14	368	858.72 (770.98-946.46)
Morgan	15	624	847.34 (780.85-913.82)
Madison	16	702	843.96 (781.52-906.39)
Lawrence	17	1129	833.26 (784.65-881.86)
Meigs	18	318	828.63 (737.56-919.71)
Crockett	19	404	824.81 (744.38-905.24)
White	20	646	817.11 (754.1-880.12)
Lauderdale	21	794	811.71 (755.25-868.18)
Franklin	22	1068	800.30 (752.3-848.3)
Rhea	23	764	793.77 (737.48-850.05)
Giles	24	785	786.08 (731.09-841.07)
Humphreys	25	483	784.99 (714.98-855)
Obion	26	858	782.69 (730.32-835.06)
Anderson	27	1839	771.53 (736.27-806.79)
Grundy	28	380	770.82 (693.32-848.32)
Henderson	29	656	768.58 (709.76-827.39)
Monroe	30	1017	765.69 (718.63-812.75)
Cannon	31	332	762.70 (680.66-844.74)
Putnam	32	1642	758.55 (721.86-795.24)
Coffee	33	1226	749.52 (707.56-791.48)
Scott	34	545	749.26 (686.35-812.16)
Roane	35	1319	749.15 (708.72-789.58)
Warren	36	975	744.02 (697.32-790.72)
McMinn	37	674	738.20 (682.47-793.93)
Haywood	38	474	731.50 (665.64-797.35)
Hardeman	39	763	731.49 (679.59-783.4)
McNairy	40	1731	730.42 (696.01-764.83)
Blount	41	2607	729.94 (701.92-757.96)
Grainger	42	521	727.35 (664.89-789.81)
Clay	43	195	724.14 (622.5-825.78)
Jackson	44	270	715.78 (630.4-801.16)
Lewis	45	280	714.80 (631.07-798.52)
Hickman	46	581	708.91 (651.26-766.55)
Maury	47	669	706.35 (652.82-759.88)
DeKalb	48	423	705.90 (638.63-773.17)
Smith	49	424	705.23 (638.1-772.35)
Greene	50	1502	704.62 (668.99-740.26)
Hamblen	51	1392	696.73 (660.13-733.34)
Pickett	52	118	695.74 (570.21-821.28)
Jefferson	53	1054	693.54 (651.67-735.41)
Cocke	54	790	693.36 (645.01-741.71)
Robertson	55	1301	690.29 (652.78-727.8)
Sullivan	56	3518	680.78 (658.28-703.27)
Dyer	57	844	676.62 (630.97-722.26)
Hamilton	58	6916	671.88 (656.04-687.71)
Macon	59	1089	659.61 (620.43-698.78)
Trousdale	60	162	659.42 (557.88-760.97)
Weakley	61	777	657.32 (611.1-703.54)
Sevier	62	1582	653.68 (621.46-685.89)
Unicoi	63	392	652.80 (588.18-717.43)
Dickson	64	948	644.08 (603.08-685.08)
Washington	65	2331	639.86 (613.89-665.84)
Wayne	66	413	637.81 (576.3-699.33)
Bedford	67	828	636.64 (593.28-680)
Hardin	68	559	635.92 (583.21-688.64)
Van Buren	69	122	635.08 (522.38-747.77)
Marion	70	443	634.76 (575.65-693.87)
Polk	71	349	631.63 (565.36-697.89)
Knox	72	8125	628.03 (614.37-641.69)
Marshall	73	1912	623.77 (595.81-651.73)
Hawkins	74	1130	623.47 (587.12-659.82)
Lake	75	205	608.47 (525.18-691.77)
Fayette	76	590	599.86 (551.45-648.26)
Chester	77	314	598.31 (532.13-664.49)
Tipton	78	1046	597.17 (560.98-633.36)
Davidson	79	11318	585.00 (574.22-595.78)
Hancock	80	135	581.68 (483.55-679.8)
Shelby	81	17320	577.80 (569.2-586.41)
Bradley	82	1651	551.11 (524.53-577.7)
Sumner	83	2440	544.82 (523.2-566.43)
Wilson	84	1624	532.40 (506.51-558.3)
Sequatchie	85	198	508.73 (437.87-579.59)
Carter	86	959	499.49 (467.88-531.1)
Union	87	305	494.56 (439.05-550.06)
Williamson	88	2113	491.43 (470.47-512.38)
Lincoln	89	519	489.71 (447.58-531.84)
Cheatham	90	615	489.67 (450.97-528.37)
Bledsoe	91	207	441.73 (381.55-501.91)
Montgomery	92	1896	401.60 (383.53-419.68)
Rutherford	93	2428	384.94 (369.62-400.25)
Johnson	94	234	358.03 (312.16-403.91)
Moore	95	58	295.74 (224.57-382.31)
Tennessee		124802	645.38 (641.8-648.96)

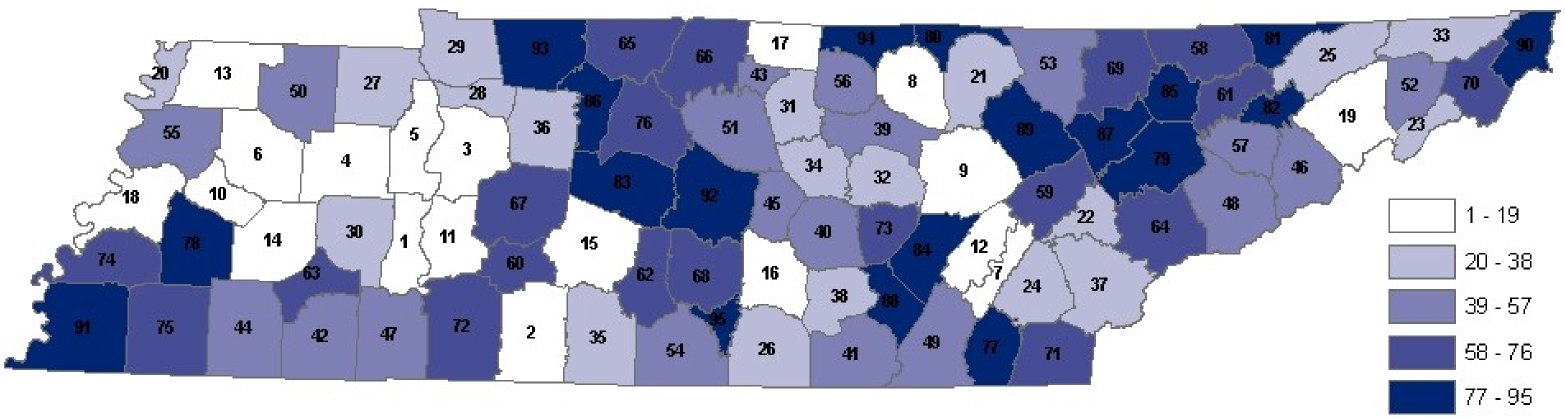
Male Out-Patient Cases Ranked by Crude Rate



ALL CANCERS MALE OUT-PATIENTS 1998-2003, Ranked by Crude Rates

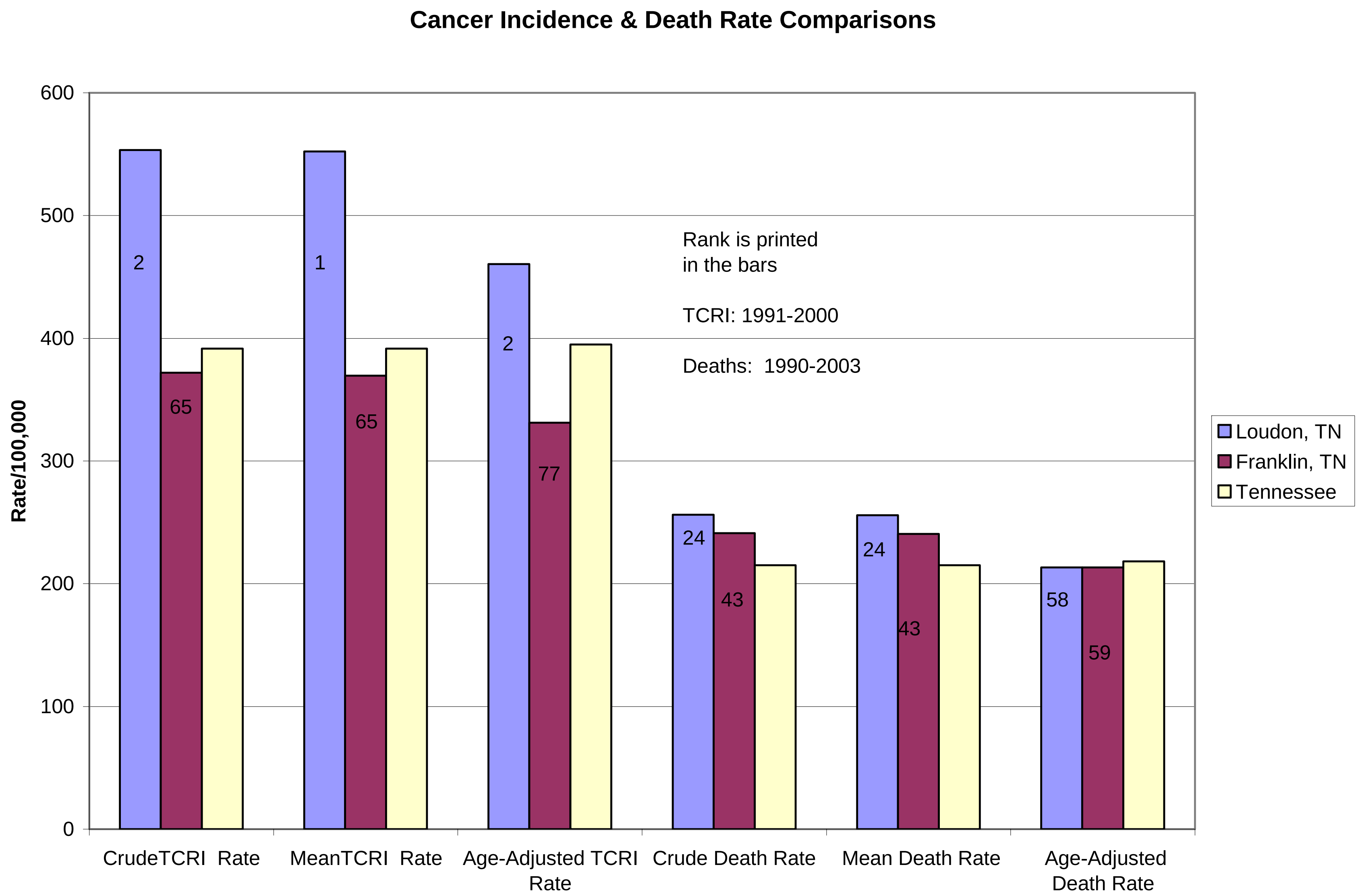
County	Rank	Number	Crude Rate
Decatur	1	335	982.23 (877.05-1087.42)
Humphreys	2	405	764.05 (689.64-838.46)
Lawrence	3	876	750.88 (701.16-800.61)
Meigs	4	238	714.31 (623.56-805.06)
Gibson	5	974	712.39 (667.65-757.13)
Crockett	6	295	699.73 (619.88-779.58)
Carroll	7	579	680.90 (625.44-736.37)
Benton	8	327	680.09 (606.37-753.8)
Madison	9	478	667.19 (607.38-727)
Perry	10	150	660.71 (554.97-766.44)
Obion	11	614	652.40 (600.8-704)
Cumberland	12	889	650.65 (607.88-693.42)
Overton	13	382	646.87 (582-711.73)
Rhea	14	535	645.37 (590.68-700.06)
Macon	15	890	625.74 (584.63-666.85)
McMinn	16	484	614.03 (559.32-668.73)
Unicoi	17	317	613.54 (546-681.09)
Maury	18	499	611.74 (558.06-665.41)
Henry	19	545	604.80 (554.03-655.58)
Coffee	20	839	595.74 (555.43-636.05)
Hawkins	21	926	592.24 (554.1-630.39)
Loudon	22	677	589.60 (545.18-634.01)
Greene	23	1084	589.35 (554.27-624.44)
Lauderdale	24	497	586.10 (534.57-637.63)
Franklin	25	672	584.69 (540.48-628.9)
Henderson	26	430	582.71 (527.63-637.79)
Stewart	27	212	572.80 (495.7-649.91)
Giles	28	491	571.08 (520.57-621.6)
Fentress	29	276	562.65 (496.27-629.03)
Houston	30	135	560.72 (466.14-655.31)
Smith	31	293	560.67 (496.47-624.87)
Sullivan	32	2442	550.71 (528.86-572.55)
Dickson	33	697	546.45 (505.88-587.02)
Monroe	34	623	540.60 (498.15-583.05)
Grundy	35	229	540.48 (470.47-610.48)
DeKalb	36	278	536.02 (473.01-599.03)
McNairy	37	1086	531.74 (500.11-563.36)
White	38	362	531.06 (476.35-585.76)
Marion	39	318	527.63 (469.63-585.62)
Trousdale	40	111	520.78 (423.9-617.67)
Lake	41	149	517.36 (434.29-600.43)
Warren	42	584	515.94 (474.09-557.78)
Hardin	43	389	513.46 (462.44-564.49)
Hardeman	44	465	513.44 (466.77-560.11)
Cannon	45	193	513.09 (440.7-585.48)
Putnam	46	957	512.01 (479.57-544.45)
Weakley	47	516	507.41 (463.63-551.2)
Scott	48	315	501.08 (445.75-556.42)
Lewis	49	167	495.06 (419.98-570.15)
Washington	50	1553	494.36 (469.77-518.94)
Cocke	51	484	493.19 (449.25-537.13)
Sevier	52	1033	492.66 (462.61-522.7)
Hamilton	53	4295	485.78 (471.25-500.31)
Dyer	54	515	480.00 (438.54-521.45)
Lincoln	55	436	477.89 (433.03-522.75)
Chester	56	217	476.42 (413.03-539.81)
Marshall	57	1256	474.6 (448.35-500.85)
Wilson	58	1242	469.36 (443.26-495.46)
Jackson	59	152	467.13 (392.87-541.39)
Roane	60	705	465.98 (431.58-500.37)
Jefferson	61	612	464.3 (427.51-501.08)
Claiborne	62	398	459.24 (414.12-504.36)
Blount	63	1413	458.16 (434.27-482.05)
Bedford	64	508	450.59 (411.4-489.77)
Robertson	65	735	449.89 (417.37-482.42)
Sumner	66	1712	443.9 (422.87-464.93)
Grainger	67	273	441.1 (388.77-493.42)
Carter	68	719	435.5 (403.67-467.33)
Campbell	69	499	433.36 (395.34-471.39)
Wayne	70	238	427.45 (373.14-481.76)
Polk	71	203	426.37 (367.72-485.03)
Hickman	72	300	421.98 (374.23-469.73)
Fayette	73	353	414.49 (371.25-457.73)
Tipton	74	628	412.94 (380.64-445.23)
Van Buren	75	67	406.23 (314.83-515.9)
Bradley	76	1036	400.64 (376.24-425.04)
Davidson	77	6399	384.35 (374.93-393.77)
Haywood	78	211	380.43 (329.1-431.76)
Knox	79	4167	374.5 (363.13-385.87)
Pickett	80	54	370.07 (278-482.85)
Williamson	81	1362	361.43 (342.24-380.63)
Hamblen	82	618	358.66 (330.38-386.93)
Hancock	83	71	357 (278.82-450.3)
Union	84	189	353.72 (303.29-404.15)
Bledsoe	85	141	348.4 (290.89-405.9)
Cheatham	86	356	327.99 (293.92-362.06)
Sequatchie	87	111	327.81 (266.83-388.8)
Anderson	88	645	315.91 (291.53-340.3)
Johnson	89	176	312.91 (266.68-359.14)
Shelby	90	7726	299.52 (292.84-306.2)
Morgan	91	189	297.96 (255.48-340.44)
Rutherford	92	1503	274.21 (260.34-288.07)
Montgomery	93	1055	258.28 (242.69-273.86)
Clay	94	58	250.54 (190.25-323.88)
Moore	95	40	235.36 (168.15-320.5)
Tennessee		73120	438.43 (435.25-441.61)

Male Out-Patient Cases Ranked by Mean Rate



ALL CANCERS MALE OUT-PATIENTS 1998-2003, Ranked by Mean Rates

County	Rank	Number	Mean Rate
Decatur	1	335	761.86 (680.28-843.45)
Lawrence	2	876	666.67 (622.52-710.82)
Humphreys	3	405	653.47 (589.82-717.11)
Carroll	4	579	608.54 (558.97-658.1)
Benton	5	327	603.71 (538.27-669.14)
Gibson	6	974	602.31 (564.48-640.14)
Meigs	7	238	597.50 (521.59-673.41)
Overton	8	382	593.28 (533.78-652.77)
Cumberland	9	889	582.12 (543.85-620.38)
Crockett	10	295	577.61 (511.69-643.52)
Perry	11	150	576.92 (484.59-669.24)
Rhea	12	535	566.60 (518.59-614.61)
Obion	13	614	550.91 (507.34-594.49)
Madison	14	478	548.74 (499.55-597.94)
Maury	15	499	534.75 (487.83-581.67)
Coffee	16	839	529.36 (493.54-565.19)
Macon	17	890	527.89 (493.21-562.57)
Lauderdale	18	497	520.17 (474.44-565.9)
Greene	19	1084	518.17 (487.32-549.02)
Lake	20	149	517.50 (434.41-600.6)
Fentress	21	276	514.99 (454.24-575.75)
Loudon	22	677	512.91 (474.27-551.54)
Unicoi	23	317	512.86 (456.4-569.31)
McMinn	24	484	512.57 (466.91-558.24)
Hawkins	25	926	512.50 (479.49-545.51)
Franklin	26	672	510.33 (471.75-548.92)
Henry	27	545	502.86 (460.64-545.08)
Houston	28	135	493.79 (410.49-577.08)
Stewart	29	212	493.44 (427.01-559.86)
Henderson	30	430	493.18 (446.57-539.8)
Smith	31	293	489.56 (433.5-545.61)
White	32	362	487.59 (437.36-537.82)
Sullivan	33	2442	487.03 (467.72-506.35)
DeKalb	34	278	482.71 (425.97-539.45)
Giles	35	491	482.50 (439.82-525.18)
Dickson	36	697	478.49 (442.97-514.01)
Monroe	37	623	477.45 (439.96-514.95)
Grundy	38	229	476.44 (414.73-538.15)
Putnam	39	957	464.70 (435.26-494.14)
Warren	40	584	458.56 (421.37-495.75)
Marion	41	318	456.22 (406.08-506.37)
McNairy	42	1086	453.66 (426.68-480.64)
Trousdale	43	111	451.50 (367.51-535.5)
Hardeman	44	465	441.92 (401.75-482.08)
Cannon	45	193	438.78 (376.87-500.68)
Cocke	46	484	438.07 (399.04-477.1)
Hardin	47	389	436.23 (392.88-479.58)
Sevier	48	1033	433.42 (406.99-459.85)
Hamilton	49	4295	427.38 (414.6-440.17)
Weakley	50	516	418.19 (382.11-454.28)
Wilson	51	1242	418.01 (394.76-441.26)
Washington	52	1553	417.39 (396.63-438.15)
Scott	53	315	416.79 (370.76-462.82)
Lincoln	54	436	416.78 (377.66-455.9)
Dyer	55	515	413.70 (377.97-449.43)
Jackson	56	152	412.55 (346.97-478.14)
Jefferson	57	612	408.83 (376.44-441.22)
Claiborne	58	398	408.28 (368.17-448.39)
Roane	59	705	406.95 (376.91-436.99)
Lewis	60	167	404.22 (342.91-465.53)
Grainger	61	273	402.91 (355.12-450.71)
Marshall	62	1256	401.29 (379.09-423.48)
Chester	63	217	400.78 (347.46-454.11)
Blount	64	1413	397.73 (376.99-418.46)
Robertson	65	735	392.21 (363.86-420.57)
Sumner	66	1712	391.78 (373.22-410.34)
Hickman	67	300	390.06 (345.92-434.2)
Bedford	68	508	384.20 (350.79-417.61)
Campbell	69	499	382.17 (348.64-415.71)
Carter	70	719	381.35 (353.48-409.23)
Polk	71	203	375.31 (323.68-426.94)
Wayne	72	238	362.60 (316.54-408.67)
Van Buren	73	67	357.63 (277.16-454.18)
Tipton	74	628	352.94 (325.34-380.55)
Fayette	75	353	350.36 (313.81-386.91)
Davidson	76	6399	342.69 (334.3-351.09)
Bradley	77	1036	342.10 (321.27-362.94)
Haywood	78	211	339.00 (293.26-384.75)
Knox	79	4167	332.76 (322.65-342.86)
Pickett	80	54	329.98 (247.89-430.55)
Hancock	81	71	326.98 (255.37-412.43)
Hamblen	82	618	316.36 (291.42-341.31)
Williamson	83	1362	314.94 (298.21-331.66)
Bledsoe	84	141	311.29 (259.91-362.68)
Union	85	189	303.59 (260.3-346.87)
Cheatham	86	356	294.40 (263.81-324.98)
Anderson	87	645	284.10 (262.18-306.03)
Sequatchie	88	111	271.67 (221.13-322.2)
Morgan	89	189	267.96 (229.76-306.17)
Johnson	90	176	263.65 (224.7-302.6)
Shelby	91	7726	254.94 (249.26-260.63)
Rutherford	92	1503	249.21 (236.61-261.81)
Montgomery	93	1055	231.35 (217.39-245.32)
Clay	94	58	228.49 (173.5-295.38)
Moore	95	40	212.83 (152.05-289.81)
Tennessee		73120	382.67 (379.9-385.44)


Cancer Incidence & Death Rate Comparisons
600
500
400
300
200
100
0
Rate/100,000
2
65
1
65
2
77
24
43
24
43
58
59
Rank is printed in the bars
TCRI: 1991-2000
Deaths: 1990-2003
Loudon, TN
Franklin, TN
Tennessee
CrudeTCRI Rate
MeanTCRI Rate
Age-Adjusted TCRI Rate
Crude Death Rate
Mean Death Rate
Age-Adjusted Death Rate

Appendix H
Detailed Methods of Data Analysis

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In order to analyze health outcome data in a meaningful way, EEP selected a comparison county. Counties considered for selection included peer counties identified by the Community Health Status Indicators (CHSI) Project, sponsored by the Health Resources and Services Administration (HRSA). The Community Health Status Reports for this project list Franklin, Coffee, Jefferson, and Loudon Counties as peer counties; EEP believes that Franklin County is the best match for Loudon County for this project (HRSA 2000) because Franklin and Loudon counties have similar demographic compositions but differ with respect to the concentration of industries present with Franklin County having fewer industries.

Mortality data from Health Information Tennessee (HIT)

Initially, EEP reviewed health statistics data found on the Department of Health HIT site (http://www.tennessee.gov/health) for the years 1990 through 2002 to compare the top 10 causes of death between Loudon and Franklin Counties and all of Tennessee. This data consisted of rates adjusted to the age distribution of the 2000 U.S. standard population and are given per 100,000 people. The Tennessee population projections used by the Tennessee Department of Health for rate calculations were prepared by the University of Tennessee using direct methods. While this results in more accurate projections than those obtained through the indirect methods employed by the US Census Bureau, use of these projections will give slightly different disease rates. Such rates, however, more readily consider regional circumstances and thus, is our preferred approach. In addition, coding for the various causes of death presented at the HIT site, excludes some conditions that may be of interest in this particular assessment and should be noted:

- The codes for diseases of the heart exclude hypertension;
- The codes for cerebrovascular diseases exclude diseases of the arteries, arterioles, and capillaries;
- The codes for chronic lower respiratory diseases exclude acute upper respiratory infections, respiratory conditions due to external agents (such as asbestosis), and pulmonary and pleural diseases.

To determine if the rates for the leading causes of death in Loudon County significantly differ from Franklin County and Tennessee over time, EEP completed two sample, one-tailed and two-tailed, student t-tests, in the statistical analysis program SAS™, using six different hypotheses for testing. This method has been employed by the CDC under similar circumstances (http://www.cdc.gov/mmwr/preview/mmwrhtml/ss5101a1.htm). For these evaluations, EEP defined statistical significance as a p-value of 0.05 or less. The six hypotheses are detailed below.

7. Loudon County age-adjusted rate is significantly different from that of Franklin County (two-tailed t-test)
8. Loudon County age-adjusted rate is significantly higher that of Franklin County (one-tailed t-test)
9. Loudon County age-adjusted rate is significantly lower that of Franklin County (one-tailed t-test)
10. Loudon County age-adjusted rate is significantly different from that of Tennessee (two-tailed t-test)
11. Loudon County age-adjusted rate is significantly higher that of Tennessee (one-tailed t-test)

12. Loudon County age-adjusted rate is significantly lower that of Tennessee (one-tailed t-test)

Detailed analysis of health outcome data

In order to more thoroughly understand disease trends with respect to the air emissions under consideration and community concerns about respiratory and heart-related illnesses, additional analyses were performed on records of Tennessee residents for the 41 specific diseases listed in Appendix D. Data available about these diseases includes: 1) death certificate information from 1990 through 2003; 2) in-patient hospital discharge data from 1997 through 2003; 3) out-patient hospital discharge data from 1998 through 2003 with 2003 data being provisional; and 4) Tennessee Cancer Registry (TCR) incidence case data from 1991 through 2000. Although available, out-patient hospital discharge data from 1997 was excluded because only one of two hospitals in Franklin County provided out-patient data for that year, leading to substantial underreporting for the year 1997. It is also important to note that prior to 2000, hospitals reported emergency room visits and out-patient ambulatory surgeries, but only reported 23-hour observations at their discretion. Thus, increases in disease frequencies for 2000-2003 may in part be due to increased reporting. Finally, hospital discharge data does not include information about disease incidence observed outside of the hospital setting such as non-hospital clinics and private physician offices. Rather, it only provides a snap shot of illnesses severe enough to result in hospitalization. While this misses the window of opportunity to prevent illness at the earliest possible stage, it is the only information we have available about the non-cancer morbidity experience of Loudon County, Franklin County and Tennessee residents.

For evaluation purposes, the underlying cause of death for each death record was determined. Likewise, the primary cancer diagnosis among cancer incidence cases provided by the TCR was identified. Within the hospital discharge system, however, a patient may have up to nine diagnoses for each hospital visit. All nine diagnostic fields were reviewed for each year of available data. This is a much more conservative approach than considering only the first diagnosis listed. Because we know we are missing nonhospital visits and were concerned about underreporting, we chose this approach to develop a more thorough understanding of disease morbidity.

Since it is possible for a hospital patient to be seen multiple times in one year, we took additional data management measures to identify duplicate patients by isolating records with identical demographic information. The patient's hospital record number, scrambled social security number, date of birth, race, sex, and county of residence were taken into account for this purpose. For example, if a Tennessee resident utilizes a Tennessee hospital five times for asthma in 2000 and three times for ischemic heart disease in 2000, one asthma patient and one ischemic heart disease patient will be counted for 2000 accordingly. If that same Tennessee resident utilizes a Tennessee hospital an additional four times for asthma in 2001, he or she will also be counted as one asthma patient in 2001. Groups of multiple diagnoses and co-morbidities were not considered in this analysis. Finally, considering differences in data quality and time frames, in-patient data was analyzed independently from out-patient data. That being the case, it is possible for one individual to be both and in-patient and out-patient for the same conditions in any given year.

After determining the number of patients seen at least once for each of the 41 diseases evaluated, disease rates for Loudon County, Franklin County, and the state of Tennessee were calculated using population estimates provided by the Tennessee Division of Health Statistics that are routinely used for other analyses. This readily allows comparison of results of these analyses to other reports produced by the Division of Health Statistics. These same population data were also used to calculate death rates and cancer incidence rates for each year that data were available. As stated earlier, use of these population projections may result in slightly different rates than those obtained from using US Census Bureau population data but we feel they more accurately depict local conditions. All rate calculations and statistical tests of difference were performed using the statistical computer software, SAS™. The median age and age range for each of the diseases evaluated were also calculated in SAS™.

Discussion of Data Limitations

Mortality records for the years indicated (1990 through 2003) are complete and reliable. As mentioned above, hospital data may miss some cases of disease if the person saw a private physician at his/her office not associated with a hospital or if the hospital clinic chooses not to report. However, reporting from area hospitals is required by law and is generally good. In-patient hospital data is more reliable and complete than out-patient data for the years 1997 through 2003 for two primary reasons. First, longer stays provide additional opportunities to obtain more complete information. Secondly, the higher costs associated with in-patient hospitalization increases interest in cost recovery, which requires more detailed patient information. In both instances, diagnoses are not verified. Diagnoses for the TCR incidence data are verified but case identification is only about 80% complete. This problem is compounded by the fact that some types of cancer may be reported more thoroughly than others. For example, more aggressive cancers with shorter survival likelihoods may be missed as incidence cases and only captured as mortality events. The important thing to remember when interpreting the health outcome results is that none of the four data sources are perfect; each has its strengths and weaknesses. Furthermore, lifestyle and occupational history information does not accompany any of the health data reviewed. For these reasons, analysis of the data can be used as indicators of statistically significant rate differences, but not as definitive conclusions about the health status of a county or community. A summary of data limitations follows.

Death Data Limitations:
1) These are the most accurate of the data sources considered.
2) It is possible that some non-military-related deaths of Tennessee residents occurring abroad are not captured.
3) Additional efforts are not made to verify diagnoses.

TCR Incidence Limitations:
1) TCR reports these data to be approximately 80% complete but diagnoses are verified.
2) No attempts were made to distinguish diagnoses originating in Tennessee from those originating outside of Tennessee, i.e., information about the duration of current residence and previous residence(s) are not available.
3) No attempts were made to distinguish current conditions from resolved conditions.

Hospital Data Limitations:
1) These data exclude all health care encounters at private clinics and other non-hospital facilities as well as self-treatment. Said another way, these data reflect illnesses severe enough to require some form of hospitalization. They are not likely to reflect early detection of disease or the entire disease experience of any one county or the state of Tennessee.
2) In spite of the efforts taken to identify unique patients, missing or incorrect information for some records may have prevented the complete detection of duplicate patients. Likewise, such errors make it possible for a person to be counted as a resident of more than one county in any given year.
3) No attempts were made to verify diagnoses reported in the hospital records with laboratory results or other information.
4) No attempts were made to distinguish diagnoses originating in Tennessee from those originating elsewhere.
5) No attempts were made to distinguish current conditions from resolved conditions.
6) This only includes data from Tennessee hospitals. It does not include data from hospitals in other states that Tennessee residents go to for care.
7) The hospital discharge system is a financial billing system; it is not intended to track health outcomes even though it is commonly used that way. Because it is a billing system, additional information to better understand health experiences may not be available.

Rate Calculations and Formulas for the draft Loudon Public Health Assessment
The draft Loudon Public Health Assessment released for public comment included mean disease rates for all years in which data was available. The reason for this was to address the community question: Do the disease rates for Loudon County differ significantly over time when compared to Franklin County and the state of Tennessee? Given the data limitations, the statistical method that most appropriately targets this question is the student t-test where variance among annual rates is taken into account. This method calculates a mean rate from annual disease rates and compares how annual disease rates differ from the mean. It also calculates a p-value to indicate how significant differences from the mean are. The formula used to calculate mean rates is:

$$Mean\ Rate = \left[\sum \left(\frac{Total\ Number\ of\ Events\ for\ a\ Specific\ Year}{Total\ Population\ for\ a\ Specifc\ Year} \times 100{,}000\right)\right] \div Number\ of\ Years$$

This approach has been employed under similar circumstances elsewhere (http://www.cdc.gov/mmwr/preview/mmwrhtml/ss5101a1.htm).

Rate Calculations and Formulas for the Final Loudon Public Health Assessment
From comments received at the public meeting and during the comment period, two other questions arose about the health data. The first question was: Why were mean rates used instead of crude rates? Crude rates can sometimes be more sensitive to changes in population structure than mean rates so in response to these questions we have added crude rates to the final report. The second question was: Relatively speaking, how does the health experience differ between Loudon County, Franklin County and the state of Tennessee? While this seems similar to the initial question raised, it is less concerned with change over time and more interested in broader, big picture, differences. To address this question, we also added crude relative risk ratios (more properly referred to as rate ratios under these circumstances) to the final analyses. The formulas used for these tasks are:

$$Crude\ Rate = \frac{Total\ Number\ of\ Events\ for\ all\ Years}{Total\ Population\ for\ all\ Years} \times 100{,}000$$

$$Rate\ Ratio = \frac{\dfrac{Total\ Number\ of\ Events\ for\ all\ Years\ for\ Area1}{(Total\ Population\ for\ all\ Years\ for\ Area1) - (Total\ Number\ of\ Events\ for\ all\ Years\ for\ Area1)}}{\dfrac{Total\ Number\ of\ Events\ for\ all\ Years\ for\ Area2}{(Total\ Population\ for\ all\ Years\ for\ Area2) - (Total\ Number\ of\ Events\ for\ all\ Years\ for\ Area2)}}$$

Age-adjusted Rates

For these analyses, age-adjusted rates were not the primary comparisons used for two main reasons. First, when the number of events is small, rates tend to be unstable. In fact, the National Center for Health Statistics considers rates based on frequencies less than 20 to generally be unstable and recommends such rates to be interpreted with caution (McCandless and Oliva, 2003, NAHDO 2004). While the goal of age-adjusted rates is to allow for comparisons between populations independent of age structure, problems resulting from unstable rates can be amplified, especially if the age distribution of a population has undergone changes in specific age groups that adjustment procedures fail to capture adequately. Under such circumstances, one may falsely conclude little difference exists when that may not be the case or vice versa. This problem is sometimes reflected in larger confidence intervals for age-adjusted rates and rate ratios in comparison to crude rates and rate ratios, making interpretations more difficult rather than expanding knowledge of the situation at hand. In addition, if the age proportions used to adjust rates do not adequately reflect the age distribution of the population under study, age-adjusted rates may be further biased. For example, if the age distribution of the population under study is much younger than the average US 2000 population, which is generally the standard used in age-adjustment, disease rates may falsely appear to be much higher than the true community experience and therefore, crude rates may be more meaningful. Similarly, if the age distribution of the population understudy is much older than the average US 2000 population, disease rates may falsely appear to be much lower than the true community experience and crude rates may once again be more meaningful.

With this health assessment, we are faced with the fact that the number of events for many of the health issues we reviewed are below 20. Crude rates, which are subject to the same stability problems as age-adjusted rates, reflect the magnitude of a community's health experience. In this health assessment, we felt it was important to capture that magnitude. Here, the small number of events for many health issues may make age-adjustment an additional source of confusion rather than clarity, especially when trying to understand experiences across health issues. To minimize biased interpretations, rather than present age-adjusted rates for some health issues and crude rates for others, we felt it would be less confusing to present the more conservative, crude rates for all. Such an approach provides us with a more common ground to identify issues warranting further investigation. However, we did calculate age-adjusted rates for all health outcomes and take them into consideration. To minimize confusion, we maintained the age-adjusted rate information separately and did not incorporate it with the crude and mean rate information.

Secondly, the comparison population used in this assessment, Franklin County, was chosen because it has a very similar age distribution to Loudon County. That being the case, adjusting rates for two populations with very similar age proportions does not offer further explanation of rate differences. As stated earlier, to provide information about the magnitude of impact that age may have on disease experiences, especially those with frequencies less than 20, we have included the median age and age range for each of the diseases analyzed in the final report as we did in the draft report.

Finally, since rates for all cancers ranked Loudon County as the highest in Tennessee with respect to mean rates and second highest with respect to crude ranks, we took an extra careful look at the impact of age-adjustment on cancer rates for all counties in Tennessee. These are presented separately in Appendix G. The formula used to calculate age-adjusted rates is:

$$Age\text{-}Adjusted\ Rate = \sum \left[Age\ Proportion \left(\frac{Total\ Number\ of\ Events\ for\ all\ Years\ for\ Specific\ Age\ Group}{Total\ Population\ for\ all\ Years\ for\ Specifc\ Age\ Group} \times 100{,}000 \right) \right]$$

The age groups and corresponding proportions used for this formula and used by the Tennessee Department of Health, Division of Health Statistics routinely, are:

AGE GROUP	AGE RANGE	US 2000 proportion
1	Less than 1	0.013818
2	1-4	0.055317
3	5-14	0.145565
4	15-24	0.138646
5	25-34	0.135573
6	35-44	0.162613
7	45-54	0.134834
8	55-64	0.087247
9	65-74	0.066037
10	75-84	0.044842
11	85 and older	0.015508

Appendix I

Community Concerns

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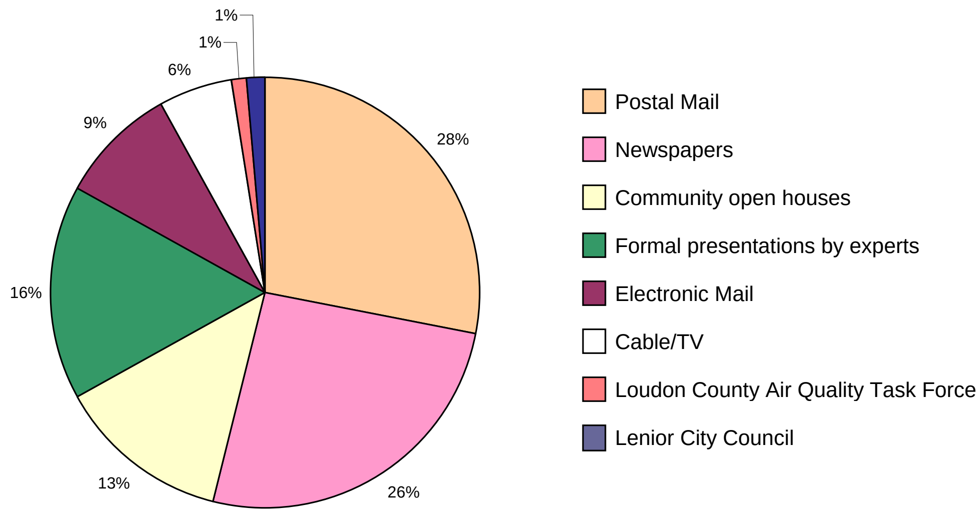
Fifteen percent of residents have children living with them. Loudon is home to many retirees who mentioned that although children are not living in their home, grandchildren come to visit often, some for extended stays. Children's health is a main focus of concern. This will be discussed more thoroughly in the next section, Community Concerns.

As shown in the following figure, most people want to receive information about the Loudon Public Health Assessment process by mail and in newspapers. The preferred newspapers are the Village Connection, the Loudon News- Herald, and the Knoxville News Sentinel.

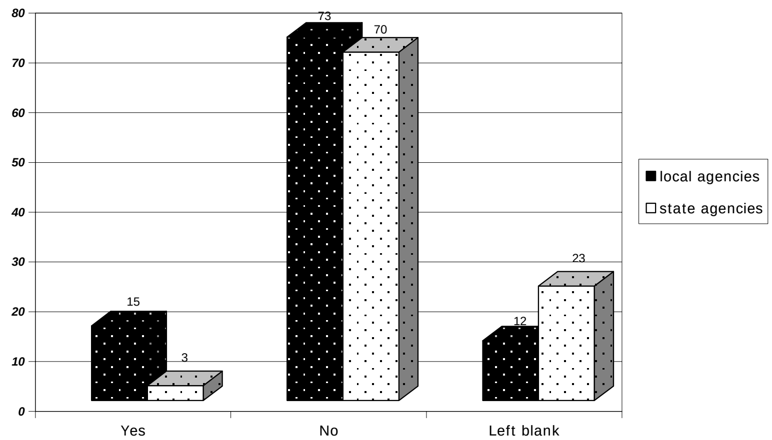
Figure 2. Percentage of respondents wishing to receive information by various means. Loudon County Open House. July 14 and 15, 2004.



An overwhelming majority of respondents wanted information about the chemicals that have been found in the air in Loudon (90%), information on health outcomes such as asthma (88%), and information about how people may come into contact with those chemicals (73%).

When asked if they felt that governmental agencies were responding appropriately to concerns about environmental health in their community, most people said no. Respondents provided some more descriptive information about their concerns and governmental agencies which can be found in the next section, Community Concerns.

Fig. 3. Appropriateness of local and state governmental response to community concerns. Loudon County Open House. July 14 and 15, 2004.



Community Concerns

During the public open house Wednesday, July 14, and Thursday, July 15, 2004 we asked people two open-ended questions. These were:

- What are your main concerns about potential environmental health issues in Loudon?
- Are there any other environmental concerns or comments you would like to provide?

Separating environmental and health concerns is a difficult task because it is well known that a community's environment directly affects that community's health. As well, a community's health directly affects their environment. Since there were so many overlaps of concerns listed by respondents, we fused these concerns together in this section. This section describes the various community concerns that were identified to EEP and a summary of EEP's evaluation. Many concerns were repeated by several community members. Themes were catalogued with subheadings. The concerns/questions are detailed first, followed by the EEP response in *italics*.

Community Concern #1: Air pollution

a. Community members expressed great concern regarding air pollution. They had questions regarding the origin of the pollution. A member of the community asked about the cause of increased haziness, possibly coming from Ohio. There are strong beliefs that the air is getting worse, and that Loudon is one of the most polluted areas in the United States. Residents were concerned about Loudon's Toxic Release Inventory status.

b. Specific health concerns that were identified during the open house include various respiratory symptoms and diseases: pneumonia, asthma, coughing, bronchitis, emphysema, allergies, trouble breathing, and chronic pulmonary obstructive disease. Many community members were concerned that asthma rates are higher in Loudon than in other areas. Community members identified childhood, adult-onset, and exercised-induced asthmas as being more prevalent in the community than elsewhere. One citizen's concern was that odors and air pollution lead to extreme coughing. Other citizens are concerned with year- round bronchitis.

Some residents stated that, since they moved to Loudon, they are now taking more medicines for allergies. Another citizen believes that his/her allergies are due to environmental contaminants. Another concern expressed is that pollution is acting in synergy with local allergens, causing worse symptoms than either trigger alone.

Some citizens state that they have trouble breathing or that on some days they "can't breathe." Some say that breathing the air is irritating. One citizen is concerned that the air is more difficult to breath than 20 years ago. A couple mentioned that when they drive through town, they take shorter breaths. Now that the HAPs monitor is in place, several citizens are concerned about what they are breathing. One person is uncomfortable breathing air that has an odor. Another community concern is that employees at the plants are required to wear respirators while local citizens work outside breathing the same pollutants as the industrial workers. Specific questions are:

- Does Loudon have increased risk for asthma and other respiratory diseases?
- Are these respiratory health problems related to air pollution in Loudon?
- Is air pollution related to heart disease?
- Do the workers at the plants wear masks around the same contaminants Loudon residents are breathing?

Loudon does not seem to have an increased rate of respiratory diseases, except for some measures of bronchus and lung cancer and consistent measures for chronic rhinitis and sinusitis. Air pollution in Loudon County may have some relationship to these problems, but it is impossible to assign causation to any particular source. Elevated levels of particulate matter may be related to heart disease (EPA 2004c, Park 2005, Brook 2004).

The Knoxville Regional Early Action Compact (EAC), which included Loudon County, was created to find solutions to lower ozone levels so that compliance with the new ozone standards would be attained. In addition, Loudon County was designated as likely to be in non-attainment of the new $PM_{2.5}$ standards. Both the Knoxville Regional EAC and the Loudon County Air Quality Task Force are working to lower ozone and $PM_{2.5}$ emissions. It is likely that sources of ozone and particulate matter from a variety of sources may have public health implications. See the section on Public Health Implications for more detail.

Workers in industrial settings often wear masks, or respirators, when their jobs require them to be exposed to high levels of chemicals, such as when they must stand near a heated source where vapors are likely to be high. These same high levels of chemicals would not be present everywhere within an industrial facility. The ambient air in Loudon does not contain levels of chemicals, found within certain sections of industrial plants, which are at levels of concern.

Other diseases/symptoms that people were concerned about include:

- Myasthenia Gravis
- Sinusitis
- Sleeping problems
- Headaches

Both Loudon and Franklin Counties reported too few cases of myasthenia gravis for meaningful statistical analysis.

Comparison of health outcome data showed elevated rates of chronic rhinitis and sinusitis in Loudon County for out-patient and in-patient data for females, males, and both sexes combined.

No information was available about the frequency of sleeping problems and headaches.

For total TRI releases to the environment, Viskase is the largest emitter in Loudon County. Viskase releases more than four times the amount of total TRI chemicals compared to A. E. Staley, the second largest Loudon County emitter. Vikase released 2,291,142 pounds of TRI chemicals into the air in 2002. A. E. Staley released 433,092 pounds of TRI chemicals in 2002. Acupowder and Malibu Boats West, Inc. released 27,901 and 127,690 pounds, respectively.
In Tennessee, there are 95 counties. Four of the industries in Loudon County rank in Top 100 TRI chemicals in Tennessee released directly to the air. These companies and their statewide rank for 2001 are listed in the following table. Viskase ranked tenth, almost entirely because of their carbon disulfide emissions. A. E. Staley ranked 28th due in large part to hydrochloric acid emissions. Acupowder reported mostly copper releases. Malibu Boats' emission was styrene.

Industries in the top 100 TRI chemical emissions to the air in Tennessee, 2001.

Rank in TN	Facility Name and Address	Total Pounds of TRI Chemicals Released to Air
10	VISKASE CORP. OF AMERICA 106 Blair Bend Dr, Loudon	2,268,148
28	A. E. STALEY MFG. CO. 198 Blair Bend Dr, Loudon	530,784
57	ACUPOWDER TN L.L.C. 6621 Hwy 411 S, Greenback	155,542
68	MALIBU BOATS WEST INC. 5075 Kimberly Way, Loudon	112,736

Scorecard, developed by the Environmental Defense Fund, does not list any Loudon industries as in the top 100 air emitters in the nation. However, the Tennessee Valley Authority (TVA) steam plant at Kingston is ranked as number 23 for air releases. Loudon County is not listed as one of top counties for air pollution from HAPs, $PM_{2.5}$, ozone, or the air quality index (AQI). Scorecard ranks areas based on the maximum AQI recorded. The AQI gives a single summary characterization of air quality. The AQI converts the measured pollutant concentrations of five criteria air pollutants in a community's air to a numerical scale of 0 to 500. The intervals on the AQI scale relate to the severity of potential health effects posed by air pollution levels. Levels above an AQI of 100 are considered unhealthful. Loudon County was not listed in the top 21 counties in Tennessee for AQI in 2001.

Community Concern #2: Specific chemicals

Community members wanted to know if they are being exposed to the following specific chemicals, and, if so, what is the exposure doing to their health:

- Arsenic
- Carbon Disulfide

- Formaldehyde
- Acetonitrile - Is it there or not there?
- Acetaldehyde

The answers to this question are found in the sections describing the HAPs, Health Outcome Data, Public Health Implications, Conclusions, and Appendices, except for arsenic. We have no information on the levels of arsenic in the air in Loudon County.

Community Concern #3: Sensitive populations

Community members were concerned about sensitive populations in their community, namely children and older adults.

a. Community members expressed great concern about the level of childhood respiratory diseases, including asthma, in Loudon. It was suggested that we interview school teachers and a local pediatrician to learn more about these concerns. At the open house we received anecdotal information that children had written essays saying that the air in Loudon stinks and that teachers had brought children inside during recess because of acute health problems caused by air pollution. Residents are concerned that children in the community live near industrial sites. Residents said that schools and parks were in close proximity to polluting industries. Some community members are grandparents whose grandchildren come for frequent visits, and they wanted to know if these children are safe. Specific questions are:

- Will you talk with the pediatrician about his health concerns?
- Could the health effects from air pollution be more harmful to these groups- children and elderly?
- Are children safe even if their schools are in close proximity to industry?

During his 24 years of practice in Loudon, the pediatrician believes he has seen a 30% rise in the asthma incidence in Loudon County. He realizes this is the same as the national trend in urban areas, but is most concerned because Loudon is a rural county, rather than an urban center. He stated that the number of new cases of asthma has increased, rather than the severity of existing cases. He attributes the fact that cases are not more severe to the increasing effectiveness of new treatment modalities. He could think of no other symptoms or diseases in children that have increased in his practice.

In an attempt to verify the anecdotes about recess, staff met and talked with school nurses because school nurses have a better knowledge than teachers of the overall health of a school. Our contact information was given to the nurses, and they were encouraged to distribute the information freely to any school employee who wished to talk with us or submit comments. Although the nurses did not believe they have a higher level of asthmatic students than other schools, they do believe that poor air quality is negatively affecting the health of their student populations. One nurse said that she sees fewer asthma cases on days when exercise and play happens inside rather than outdoors. We were unable to verify or deny the anecdotal information further.

Analysis of in-patient and out-patient hospital data and mortality data show no significant differences in rates of asthma in Loudon County compared to Franklin County and to Tennessee.

Although asthma rates were not elevated, the rates of in-patient and out-patient chronic rhinitis and sinusitis are elevated in Loudon County compared to the rates in Franklin County and Tennessee.

While it is possible that concentrations of HAPs at the schools could possibly be as high as concentrations at the monitoring station on an annual basis, the wind direction during the day is usually toward the northeast, not toward the schools. The winds generally change direction at night, so night time is when the winds from the industrial parks would blow toward the schools. Children should be safe at the schools in Loudon. See the answer for community concern #1.

b. Many community members are retirees who have chosen Loudon as their place of retirement. These community members had concerns that the pollution in Loudon would be more harmful to them in their older age. They had questions related to exercising outdoors, especially in the morning when the odors seem to be worse. They also had concerns that the elderly may be more vulnerable to the effects of pollution.

Many of people who retired and then moved to Loudon County live in Tellico Village which is approximately three to eight miles from Town of Loudon industries. Concentrations of HAPS are expected to be lower than at the monitoring station. It is highly unlikely that people living or exercising in Tellico Village would be adversely affected by the HAPs. See the discussion in the Public Health Implications section.

The lowest reported odor threshold for acetaldehyde and formaldehyde are 2.8 ppb and 20 ppb, respectively (Haz-Map), so it is likely that the odor from acetaldehyde and formaldehyde would be detected near the HAPs monitor. Occasionally, winds out of the northwest could transport emissions from Blair Bend Industrial Park to the Tellico Village area. Winds from the northwest (including north north west and west north west) occur approximately 9% to 15% of the time each month, with velocities ranging from calm conditions to about 25 miles per hour for very short periods. Modeling predicted that, if winds are coming from the northwest, the maximum 1-hour concentration of acetaldehyde could be as high as 11 ppb in the Tellico Village area. It is unlikely that 11 ppb acetaldehyde in air for short periods would cause lasting adverse health effects since 5 ppb is not expected to cause adverse health effects for a lifetime exposure.

Community Concern #4: Cancer and carcinogens

Community members were concerned that there are higher rates of cancer in Loudon and that the HAPs monitor has detected carcinogens, substances that causes cancer. A member of the community compared the data on formaldehyde from the HAPs monitor to EPA comparison values and noted that the monitoring levels were averaging ten times EPA's standards for safety. Throat and skin cancers were mentioned specifically by some residents. Specific questions were:

- Are there known carcinogens being released into the air?
- What are the harmful effects of those?
- Has Loudon had more cancer than other places due to these carcinogens?

Some of the chemicals measured at the HAPs monitor are known carcinogens and some are suspected of causing cancer. See the toxicologic discussion of the chemicals. The concentrations found seem to be within the range of concentrations found in other locations in the U.S. and around the world. Please note the discussion about the public health implications of benzene, carbon tetrachloride, acetaldehyde, and formaldehyde.

Community Concern #5: Burning sensations and irritations

Several Loudon citizens complained of burning sensations and irritations in the eyes, throat, nose, mucous membranes, tongue, and lungs. One resident specifically mentioned air pollution from Viskase as a trigger to his throat burning. Community members were concerned about their lungs burning when they breathe. The concern was that local air pollution might be causing these problems.

When aldehydes are breathed at fairly high concentrations (parts per million range), they are highly irritant to the eyes and mucous membranes of the respiratory tract. Most of the aldehydes measured at the monitoring station were found at extremely low concentrations. Acetaldehyde was found at somewhat higher concentrations, but still below the level at which irritant properties would be expected. The highest concentration of acetaldehyde measured was 4.71 ppb, with an average of 2.34 ppb. The reported concentration that causes eye irritation in a sensitive person is 25,000 ppb (HSDB).

The sampling and analysis for formaldehyde is more complex. Initially formaldehyde was found at levels averaging 19.8 ppb (range, 6.26 to 40 ppb). After April 9, 2004, the measured concentrations dropped significantly, with an average of 2.54 ppb (range, 0.715 to 3.39 ppb). However, all these concentrations are below levels at which irritation is expected.

Community Concern #6: Odor & the quality of life

Community members had several concerns related to the odors in Loudon. Some community members said they stop working or playing outdoors when the odor is bad. Some have ceased working outside altogether. A community member explained that he had no health complaints, but that odor is a quality of life issue. A member of the community wondered whether the bad odor outside meant more dangerous air. This community member jogs in the morning hours, when odor is more prevalent. According to citizen reports, on less windy days, the odor is worse. Specific questions are:

- If the odor is bad, does that mean the air is more hazardous?
- Are any of the odors harmful?

Strong and pungent odors do not necessarily mean that the air is more harmful. There are several pollutants that have no odor that could be harmful and others that have a strong odor that are not. Unpleasant odors in ambient air certainly impinge on the enjoyment people can obtain from working, exercising, and playing outdoors. Because the odors have more than one likely origin, it is difficult to know whether a stronger odor is necessarily more hazardous. At the very least, strong outdoor odors lower the quality of life for people living in those conditions.

According to the American Lung Association (ALA), "Exercise makes us more vulnerable to health damage from these pollutants. We breathe more air during exercise or strenuous work. We draw air more deeply into the lungs. And when we exercise heavily, we breathe mostly through the mouth, bypassing the body's first line of defense against pollution, the nose." There are actions that can be taken to reduce risk to air pollution. The ALA suggests the following:

- *Do train early in the day or in the evening.*
- *Do avoid midday or afternoon exercise, and avoid strenuous outdoor work, if possible, when ozone, smog, or other pollution levels are high.*
- *Do avoid congested streets and rush hour traffic; pollution levels can be high up to 50 feet from the roadway.*
- *Do make sure teachers, coaches and recreation officials know about air pollution and act accordingly.*
- *Most important, do be aware of the quality of the air you breathe! This information can be found by reviewing the Air quality Index. This is available online, through local agencies and the EPA (www.state.tn.us/environment/apc/ozone/ozoneforecast.php).*
- *Don't take air pollution lightly.*
- *Don't engage in strenuous outdoor activity when local officials issue health warnings.*

Community Concern #7: Monitoring and testing:

Community members were concerned about monitoring and testing the air and water. They said that results from the HAPs monitor appeared troublesome, and they want more HAPs monitors installed. A member of the community wanted the monitor to test for more air emissions, such as fine particles. A citizen is concerned that the data from the monitor has been edited. One person wanted more testing for specific chemicals in the water; another noted that Tennessee does not test for many harmful air and water impurities. Another wants to know when tests are being done, who is doing them, the results, and how the results are used. Specific questions are:

- What is the HAPs monitor testing?
- What do the results mean?
- Is there a way to get more air and water monitoring?

When a laboratory is sent the canister and cartridge on which the HAPs were monitored, the laboratory does the analyses. As part of any analytical chemistry procedures, raw results are adjusted to account for things like dilution, to calculate the area under the curve, and to give meaningful, accurate results.

Data on acetonitrile was found to be unreliable because of acetonitrile contamination within the sampling equipment. This problem is not unique to Loudon and has been found elsewhere, in Tennessee and in other states.

It is up to TDEC to decide if more HAPs monitors can be placed in Loudon County. The HAPs monitoring program is part of an EPA program to measure ambient concentrations of a subset of the 188 HAPs listed by EPA. The goal of the national-scale assessment is to identify those air toxics which are of greatest potential concern, in terms of contribution to population risk. The *results will be used to set priorities for the collection of additional air toxics data (e.g., emissions data and ambient monitoring data).*

Talking with the Knoxville Field Office, 888-891-8332, is the best way to ask for more monitoring of all environmental media and to find out when samples will be taken.

Community Concerns #8: Emissions from industry

Community members were concerned about the air emissions from area industries. Community members voiced concerns that industries in Loudon are not using new technology or best practices to reduce pollution/emissions. Another member indicated that nanotechnology would produce smaller particulate matter, but this could cause more harm.

Most of the community had comments specific to Tate and Lyle (A.E. Staley). Many community members expressed concern that Tate & Lyle was given a permit to pollute more. One community member claimed that the permit submitted had used the same data twice. Another community member wondered why other alcohol plants do not smell so badly- was it the coal? Other community members want them to use an oxidizer or the better technology that this company utilizes at other plants. A community member asked how the new plant will affect air quality.

Community members were concerned about the emissions from Viskase. A community member explained that new plants are able to reduce more hydrogen sulfide than the current practices at Viskase.

Many people were concerned about increasing levels of pollution from coal-fired power plants to the west and from TVA.

Other community members were concerned about the ash and sawdust that lands on their personal property.

Specific questions are:

- Are there fewer restrictions for pollution in Loudon than other places?
- If pollution is exceeding levels illegally, then why are industries not being fined?
- How can we continue to recruit industry when we live in an environment that is limited?
- Are industries in Loudon using best practices to reduce air emissions?
- What are appropriate emission standards for formaldehyde and acetaldehyde

Environmental laws to regulate industry have been established by the federal government. These laws are enforced by the US Environmental Protection Agency (EPA) and by state government when their programs have met certain standards. These laws include, but are not limited to, those in the Clean Air Act, Clean Water Act, and the Resource Conservation and Recovery Act (RCRA). Additional laws or rules may be passed by state or local governments. The Tennessee Department of Environment and Conservation permits, regulates, and enforces environmental laws and rules for the state government.

Changing the laws would require new Legislative action. Changes would be met with scrutiny from government, lobbyists, interest groups, and concerned citizens. The law making process is typically slow and difficult. Yet, many believe that the environmental laws benefit all Americans. The laws cover many aspects of environmental compliance; yet not every situation, nor every chemical, is covered in the laws.

A list of the enforcement actions taken by TDEC and/or EPA are included in the presentation of each Title V and conditional major company. Refer to the discussion that begins on page 7. The Department of Health does not enforce environmental laws. We partnered with TDEC to gain this information. To date, our Loudon County environmental public health investigation has been aided by TDEC with supporting documents, data, and verbal assistance. We believe our working relationship among the government agencies to be both positive and protective.

Industries are currently under action or are voluntarily beginning to meet new standards. No one knows the most appropriate emission standards for formaldehyde and acetaldehyde. See the discussion of the chemicals and the public health implications section.

Community Concern #9: Air Modeling

Community questions about the air modeling by UTK involve several subsets of concerns:

1. the proximity of schools to sources of air pollution and predicted concentrations of HAPs at the schools,
2. the discrepancy between modeled acetaldehyde concentrations and actual measured concentrations,
3. the differences in risks to children,
4. the differences in risk to children exposed to a mixture of formaldehyde and acetaldehyde, and
5. the meaning of $1x10^{-6}$ risk.

1. The air modeling results indicate that the predicted annual concentrations of acetaldehyde at the schools on Roberts Road (Loudon Elementary and Fort Loudon Middle) are about the same as at the air monitoring station. The concentrations predicted at the Steekee and Mulberry Street Schools (Steekee Elementary and Loudon High School) are about three times lower than at the air monitoring station. These predictions are based on wind speed and direction data collected at McGee Tyson airport for 1990. The terrain along the Tennessee River at Loudon can influence local wind speeds and direction and introduce uncertainty in the modeling results.

It is likely that the annual concentrations of acetaldehyde occurring at the four schools in downtown Loudon may be very similar to those measured at the air monitoring site. Children are at school around eight hours during the day. Measured wind roses and modeling results both show that wind directions in East Tennessee are bi-modal with prevailing winds out the southwest during the day and out of the northeast at night. It is primarily night-time winds that would transport emissions from industries in the Industrial Parks toward the schools, while winds during the day will likely transport emissions toward the northeast (Miller 2004).

2. The modeling analysis was primarily to predict particulate matter concentrations from several sources in the area. The acetaldehyde modeling was performed to predict maximum annual concentrations and 1-hour maximum concentrations for estimating odor levels due to emissions from Tate and Lyle. Predictions of concentrations of other HAPs were not made. The highest annual average concentration of acetaldehyde predicted was 6.6 ppb at a receptor 0.5 kilometer north of Tate and Lyle. The predicted maximum 24-hour average concentration at the monitoring station was 8 ppb, while the predicted annual average at the monitoring station was 0.7 ppb. Actual measurements for eight months of data are a maximum 24-hour average of 4.7 ppb and an eight-month average of 2.34 ppb.

Comparisons of predicted concentrations (ppb) of acetaldehyde to measured concentrations (ppb) of acetaldehyde at the air monitoring station, Loudon, Loudon County, Tennessee.

	Maximum 24-Hour Concentration at the monitor	Annual Average Concentration at the monitor	Maximum Annual Average Concentration at the highest receptor
Predicted concentrations	8 ppb	0.7 ppb	6.6 ppb (0.5 km north of Tate & Lyle)
Measured concentrations	4.7 ppb [1]	2.34 ppb [1]	Not applicable

[1] *From November 15, 2003 through July 26, 2004*

Modeling for predicted maximum one-hour and maximum annual concentrations of acetaldehyde was documented in "The Loudon Air Quality Study" (Miller et al. 2003). Modeling for maximum 24-hour concentration and annual average concentration of acetaldehyde was performed on March 24, 2004, at the request of APC for comparison to measurements at the monitoring station (Miller, personal communication). The later modeling was performed only for 1990 year meteorological data since it was the highest of the results for 5 years of modeling.

Modeling is not exact; the model makes predictions based on the modeler's estimate of the value and statistical distribution of variables in the complex equations used in the model. One of the major variables is the contribution to acetaldehyde concentrations from other sources, such as from vehicular emissions. No one knows the percentage contribution to total acetaldehyde concentrations from Tate and Lyle, exhaust from diesel and gasoline vehicles, and other unknown sources. *See the Discussion on page 13.*

3. While there are many studies of adults occupationally exposed to formaldehyde and exposed under acute, controlled conditions, data regarding the toxicological properties of formaldehyde in children are limited. Nevertheless, the same types of effects that occur in adults are expected to occur in children (e.g., damage in portal-of-entry tissues at exposure levels that exceed tissue detoxification mechanisms). Symptoms expected to occur in children include eye, nose, and throat irritation from exposure to airborne concentrations between 400 and 3,000 ppb. Given the water-soluble and reactive nature of formaldehyde and the apparent ubiquity of rapid cellular metabolism of formaldehyde, it is expected that the irritant effects of formaldehyde would be restricted in children, as in adults, to portals-of-entry, although no information was located comparing rates of formaldehyde metabolism in children's tissues with rates in adult *tissues, either in humans or animals. The developing fetus or nursing infant would be expected to be protected from exposure to formaldehyde (via inhalation, oral, and dermal contact) by the pregnant or breast-feeding mother. Studies of animals exposed during pregnancy to formaldehyde in air, in the diet or by gavage, or on the skin have found no distinct or consistent effects on fetal development, even at exposure levels that produced severe maternal toxicity.*

Two studies provide suggestive evidence that children may be more sensitive than adults to the irritant properties of airborne formaldehyde. However, additional research is necessary to confirm or discard the hypothesis that children may be more susceptible than adults to the irritant effects of formaldehyde and to understand the mechanistic basis of this possible difference (ATSDR 1999a).

No information was found that addressed the issue of sensitive populations for exposure to acetaldehyde.

4. No one knows very much about the toxicity of mixtures. EPA has established an RfC for acetaldehyde of 9 µg/m^3 based on based on the no observed adverse effect level (NOAEL) for degeneration of olfactory epithelium in rats. ATSDR has established a MRL of 8 ppb for chronic-duration inhalation exposure (365 days or more) to formaldehyde. The MRL is based on a minimal lowest observed adverse effect level (LOAEL) for histological changes in nasal tissue specimens from a group of 70 workers employed for an average 10.4 years (range 1–36 years) in a chemical plant that produced formaldehyde and formaldehyde resins for impregnating paper. Since the health endpoints for both chemicals are essentially the same, a safe assumption is that the toxicity of these chemicals may be additive.

So far the average 24-hour concentration of acetaldehyde is 1.62 ppb, below the RfC, but above the 1 in a million cancer risk value. The average 24-hour concentration of formaldehyde is 6.11 ppb, below the MRL, but above the 1 in a million cancer risk value. In April 2004 the measured concentrations of formaldehyde changed dramatically; at this point the reason is not known. Concentrations between November 15, 2003, and April 9, 2004 ranged from 6.26 ppb to 40 ppb, with an average of 19.8 ppb. Concentrations between April 18, 2004, and December 24, 2005, range from 0.378 ppb and 4.05 ppb, with an average of 2.02 ppb. This later average concentration is below the ATSDR MRL, but above the 1 in million cancer risk value.

5. If a chemical is a probable or known human carcinogen, EPA derives a cancer risk value for that chemical. EPA uses data from animal studies (and human epidemiology studies, if they are available) to extrapolate from high doses with known carcinogenic end points to very low doses using complex models. EPA assumes there is no threshold; that is, any exposure will result in some risk of cancer. This is an assumption that is valid is some cases and not in others, but for most chemicals we lack sufficient data to know the validity of the assumption. EPA then uses one of several models to determine the slope of the 95% upper confidence level of the extrapolated response at low concentrations. This derived slope factor is the number that represents the theoretical risk of excess cancer from exposure to the chemical in question. It is important to note that the cancer risk value is a statistically-derived number representing an upper 95% confidence level of a theoretical straight line predicting an extra cancer in one million people, *when the background lifetime risk of cancer is about one in two for men and one in three for women.*

Community Concern #10: Other environmental concerns

Community members had environmental concerns other than air pollution. These included:

- Power lines
- Meth Labs
- Far fewer hummingbirds than several years ago
- Open fires, land clearing, and burning.
- Adverse effects on soil by the air pollution in the long term
- Water quality of the area lakes
- The number of fish advisories
- Long term effects of air pollution on the water quality
- Time to clean up Loudon
- Traffic
- TVA
- Herbicide use
- Bottle law

There were many comments about traffic in the area. These are detailed below. Loudon is located in a high interstate traffic area near the confluence of I-40 and I-75 where there are many diesel trucks releasing heavy exhaust. Lenoir City has lots of truck traffic as well. Residents of Loudon identified that older cars are generally more polluting. Some support auto exhaust checks while others voiced they opposed these checks. There has been growth in Loudon County and more people mean more automobiles and boats as well as construction equipment to build new properties. Specific routes of traffic were identified by community members. A resident explained that Loudon was part of AAA's 321 route to the Smokies. Another community member suggested that the "Blue Route" (40.2 miles, from I-75 near Lenoir City to I-75 by the Clinch River near Lake City) was needed.

Specific questions are:

- What can we do about the traffic and emissions from vehicles?
- Is TVA in compliance?

Traffic: The Knoxville Region Early Action Compact (EAC) will address all issues related to ozone and $PM_{2.5}$ compliance. This will include solutions for portion of non-attainment related to traffic and emissions from vehicles. In Loudon County the Loudon County Air Quality Task Force is, also, addressing these issues. See the answer to Community Concern #1.

Bottle Law: A few years ago, the Tennessee Department of Environment and Conservation (TDEC) conducted a telephone survey to determine what environmental issues Tennesseans were most concerned about. Litter was one of the most frequent complaints. Recycling is tremendously beneficial to the environment. Recycling is an industry; recycling rates are connected to the price paid for materials. At this time, aluminum and cardboard prices are stable in the marketplace. However, glass and plastic are worth very little in the market. Glass *is heavy, messy, and must be sorted by color. Plastic is too light-weight and bulky to transport efficiently. Because the market is not favorable for recycling, some recycling rates are low. This translates potential recyclables into trash. Trash is worthless and often gets tossed out to become litter. Several states have bottle bills that collect surcharges on recyclable materials. At this point in time, there is almost zero discussion about a bottle bill for Tennessee, even though litter is recognized as a big problem by a majority of Tennesseans.*

The Knoxville Environmental Assistance Center (1-888-891-8332) has staff who will gladly share information with you about the following issues:

- *Adverse effects on soil by the air pollution in the long term*
- *Water quality of the area lakes*
- *The number of fish advisories*
- *Long term effects of air pollution on the water quality*
- *Meth Labs*
- *Open fires, land clearing, and burning*

In addition, the Region 4 Office of the Tennessee Wildlife Resources Agency (1-800-332-0900) has information about wildlife in Tennessee and about fish advisories. The Division of Natural Heritage, Bureau of Conservation, TDEC (615-532-0431), has information about biological diversity in Tennessee. The Tennessee Department of Agriculture (1-800-628-2631) has information about herbicide spraying. EEP (615-741-7247) has information on a variety of environmental issues, such as power lines. EEP will bring information about these topics to our next public meeting.

Community Concerns #11: People with no health concerns; claim of over response

Some community members attended the open house to express that they have no health concerns and are pleased with the local and state agencies. One community member endorses Staley's expansion and believes the air quality and water quality are good. One community member was concerned that state agencies are over responding to only a few community members.

Whether a citizen feels that state agencies are doing too little or too much, the Tennessee Department of Health hopes that the Public Health Assessment process will be advantageous to all citizens. Community Right-to-Know is a cornerstone of environmental protection. The efforts of the Tennessee Department of Environment and Conservation have led to a better understanding of what chemicals are in Loudon County air. This Public Health Assessment aims to interpret the data for all audiences. Our goal is to effectively meet the needs of the diverse Loudon County communities. Throughout the process, some citizens will feel that government is too involved while other citizens will feel that government is still not doing enough.

Community Concern #12: Environment and the economy

Community members were concerned about their growing economy and the environment. Some of their statements included:

- Jobs should not trade off for clean air.
- Local government more interested in tax base than public health.

- A cleaner environment does not equal fewer jobs.
- Bad press will deter new residents.
- There is too much emphasis on jobs and not enough on health care cost.

Two specific questions/comments are:

- How could our economy be affected if Loudon has tighter environmental restrictions?
- What is the evidence that economic well-being is not in danger from taking care of the environment?

There are opinions on both sides of the environment versus economy argument. Within this document, we cannot provide evidence of one argument being better in Loudon County. However, there are many examples in which working for a healthy environment has made industry more viable. Policy makers and government planners should understand the connections between environmental health and environmental cleanliness and should consider the many options available in today's world marketplace. It is up to local governments, with community input, to determine how best to balance a healthy economy with a healthy environment.

Many large industries recognize the importance of good air quality and a clean environment for attracting and keeping their workers. Typically better air conditions will favor new industries coming in because they can more easily get their air permits approved. In addition, large industries that do not require an air permit may want to locate to an area with a high quality living and working environment.

Loudon County is already in an ozone non-attainment area. Since air-borne pollution reductions are necessary to meet ozone standards, new industries need to be careful about their emissions. Industries interested in attracting working families are typically hesitant about poor air quality areas as well as the local community. Maintaining clean air might lead to a smaller number of industries that need smokestacks to operate or to those industries doing a better job of limiting their emissions.

Community Concerns #13: Dissatisfaction with agencies

Community members identified government agencies as ineffective, unwilling to help, denying an evident problem, and apathetic. Although community members have complained for years, community members feel agencies have done little to help.

On the local level community members are concerned that any action taken now would be too little, too late. Some feel that there has been a lot of talk, but no action. A member of the community was concerned that the local agencies have tried to prevent a health study. Several did not know what the local agencies were doing. Another thought that the local agencies may be over responding to some complaints.

On the state level some general concerns included:

- Agencies have denied access to information,
- Although many requests have been made, nothing is being done
- State agencies cater to businesses

- The state needs a change of attitude
- Some community members did not know what the state agencies are doing in Loudon.

The Tennessee Department of Health does not know what information citizens feel has been withheld. That said, we have not had problems accessing the information we needed in creating this Public Health Assessment. We hope that our involvement will be witnessed as a positive action and be an instrument of positive change.

Comments specific to TDEC:

- TDEC has lied to the community
- Ignored the community's concerns
- Appears to be more interested in paperwork than helping the community
- Sends people out to investigate complaints, but unless they see it with their own eyes, nothing is done.

The Department of Health is a separate agency from TDEC. We have no complaints with their willingness to provide us the information we have requested, nor can we speak on their behalf. We did, on the behalf of the citizens of Loudon County, present the community's concerns to them.

On the federal level a community member called an agency in Atlanta and was told that it would take three years for them to be able to do anything. The community member believes she will be dead by then.

Specific questions are:

- What are the agencies doing about improving our environment?
- What can be regulated?

Only three communities in the 95 counties of Tennessee have had on-going air monitoring. This project, a venture between the Tennessee Department of Environment and Conservation and the US Environmental Protection Agency, was designed to identify the amount of hazardous air pollutants present in Loudon County. Furthermore, TDEC requested our assistance in evaluating the data to ensure that the public health was protected.

Air emissions from large industrial sources are regulated. Environmental operating permits are required before smokestacks can be used. Permitted industries have mandatory reporting or inspection requirements to meet.

Automobile emissions are currently not regulated. In some Tennessee Counties, an automobile emissions testing program is used. This type of program requires that automobiles operate efficiently to minimize the air pollution they can create. The Knoxville Region Early Action Compact (EAC) is working to provide solutions to predicted non-attainment of new ozone and particulate matter standards.

Other air emissions such as from wood burning stoves and fireplaces, leaf burning, and trash burning are not regulated by federal or state law. Some local regulations may be in place to *minimize their environmental impact. Still other sources of air pollution, such as the chemicals that are blown in by the wind from other counties or other states, are not regulated.*

Community Concern #14: Loudon's future

Concerns about Loudon include:

- Loudon is becoming unfit for human habitation.
- Loudon has lost its hospital.
- There seems to be increased illness in our community.
- Emergency preparedness in case of an industrial accident.

Specific questions are:

- Will Loudon continue to be a livable city?
- Are there plans in case of an emergency at a plant?
- Are there enough masks to protect citizens if there is an emergency at a plant and hazardous chemicals are released?

EEP's understanding is that Loudon's hospital is still in existence as part of the Covenant network. The most outstanding finding of EEP's investigation of health outcome data is that Loudon County has a higher rate of chronic rhinitis and sinusitis than Franklin County or Tennessee. EEP did not see an increased rate of asthma in Loudon County, but asthma is most likely under-reported, especially for children whose asthma is under good control.

See the discussions of health outcome data, public health implications, and the discussion for information on the health of the community.

After several industrial accidents, workers and communities in several states demanded information on hazardous materials. Public interest and environmental organizations around the country accelerated demands for information in the mid-1980's on toxic chemicals being released "beyond the fence line" -- outside of the facility. Against this background, the Emergency Planning and Community Right-to-Know Act (EPCRA) was enacted in 1986.

EPCRA's primary purpose is to inform communities and citizens of chemical hazards in their areas. Sections 311 and 312 of EPCRA require businesses to report the locations and quantities of chemicals stored on-site to state and local governments in order to help communities prepare to respond to chemical spills and similar emergencies. EPCRA Section 313 requires EPA and the States to annually collect data on releases and transfers of certain toxic chemicals from industrial facilities, and make the data available to the public in the Toxics Release Inventory (TRI). In 1990 Congress passed the Pollution Prevention Act which required that additional data on waste management and source reduction activities be reported under TRI. The goal of TRI is to empower citizens, through information, to hold companies and local governments accountable in terms of how toxic chemicals are managed.

EPA compiles the TRI data each year and makes it available through several data access tools, including the TRI Explorer and Envirofacts. There are other organizations which also make the data available to the public through their own data access tools, including Unison Institute *which puts out a tool called "RTKNet" and Environmental Defense which has developed a tool called "Scorecard."*

The TRI program has expanded significantly since its inception in 1987. The Agency has issued rules to roughly double the number of chemicals included in the TRI to approximately 650. Seven new industry sectors have been added to expand coverage significantly beyond the original covered industries, i.e. manufacturing industries. Most recently, the Agency has reduced the reporting thresholds for certain persistent, bioaccumulative, and toxic (PBT) chemicals in order to be able to provide additional information to the public on these chemicals.

The Loudon County Emergency Management Agency is responsible for working with local industries to plan for disasters. Loudon County has a comprehensive Emergency Operations Plan which was approved by the Tennessee Emergency Management Agency. Any citizen may view the plan at the Loudon County Emergency Management Agency, 12680 Highway 11 West, Suite 5, Lenoir City or make an appointment to talk with the Director, Gordon Harless (865-988-0175). The public is invited and encouraged to attend the Loudon County Emergency Management Planning Committee meetings.

Appendix J

Response to Comments on the Initial / Public Comment Release Draft Public Health Assessment

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Many comments were received about the public release Loudon County Hazardous Air Pollutants Public Health Assessment. Comments were submitted in writing. In addition to comments collected during the public meeting, comments were sent via letter, fax, and email. If a comment required a change or addition to the document, that change or addition was made in the document. If a comment did not result in a change to the document, it is addressed here in Appendix J. Common comments were grouped; some comments were summarized.

Many of the same comments were received during the availability session held in Loudon in July 2004. Please read Appendix I, Community Concerns, for more detailed answers to these comments.

Comment 1:

In the collection of public comments, there were several individuals who had questions concerning data. Some people asked about access to data while others presented their own calculations using various data sources.

Answer 1:

These comments will be responded to using an approach that a citizen could repeat themselves using Air Quality System data available from the U.S. Environmental Protection Agency Internet site via http://www.epa.gov/air/data/index.html.

First, the data sets that were utilized in the Public Health Assessment: Loudon County HAPs, Loudon County, Tennessee included:

Hazardous Air Pollutants (HAPs) data: This data is collected every 12 days from a monitor near the Blair Bend Industrial Park. Data collection is part of the U.S. EPA Urban Air Toxics Monitoring Program (UATMP). The monitor collects samples that are sent to a scientific laboratory for analytical analysis. This was the key data set utilized in the health assessment. The data was provided to Environmental Epidemiology from the Division of Air Pollution Control. Data collected between November 15, 2003 and May 22, 2005, were used in the health assessment.

The EPA UATMP has released a summary report for their air monitoring sites through the end of calendar year 2003. This report is available online. Some people who provided comments on the health assessment mentioned this report. It can be viewed with Adobe Acrobat Reader at http://www.epa.gov/ttn/amtic/files/ambient/airtox/2003doc.pdf via the Internet. Keep in mind, that only 5 HAPs measurements were collected in 2003 for Loudon County.

Tennessee Cancer Registry (TCR) data: The Tennessee Cancer Registry collects data for cancer incidence. The cancer data must be reviewed for accuracy and certified for use. Currently, only a limited number of years have data available. Some of the TCR data is available on the Internet via http://www2.state.tn.us/health/TCR. Note that Environmental Epidemiology was able to use a larger data set than what is currently publicly available. Private health care providers' data were not available for use. Remember the TCR data used in *the detailed analysis of health outcome data represents years 1991-2000, whereas the data from the TDH/TCR Web site represents years 1997-2000.*

Tennessee Death Certificate data: the Office of Policy, Planning and Assessment, Health Statistics reviews death certificates to gather information on why Tennesseans died. Death certificates can list multiple causes of death such that cancer survivors that die from a non-cancer reason can still be recorded as having cancer. Data represents the years 1990-2003.

Tennessee Hospital In-patient data: the Office of Policy, Planning and Assessment, Health Statistics gathers data about in-patient hospital visits. Data represents years 1997-2003.

Tennessee Hospital Out-patient data: The Office of Policy, Planning and Assessment, Health Statistics gathers data about out-patient hospital visits. Data represents years 1998-2001.

Environmental Regulatory data: The Tennessee Department of Environment and Conservation (TDEC) is responsible for maintaining environmental regulatory standards and laws. TDEC can issue a Notice of Violation (NOV) to a company as an enforcement action. These NOVs are formal procedures that may include financial penalties. A review of TDEC files for companies in Loudon County was performed to understand their environmental track records.

Toxic Release Inventory (TRI) data: The EPA requires industries to self report quantities of potentially harmful chemical releases to the environment. TRI data is available online via http://www.epa.gov/tri; note data is presented two years after it is reported. TRI data for Loudon County is presented in Appendix B. TRI data can be useful in that it ties chemical releases to a particular industry. TRI data represent self-reported estimates and not true "end of pipe" or "top of smokestack" emissions.

Scientific Literature data: Although not a data set of numbers in a spreadsheet, the scientific literature was an important collection of information used in preparing this health assessment. Toxicological Profiles prepared by the federal Agency for Toxic Substances and Disease Registry (ATSDR), as listed in the References section, are great summaries of what is known about a particular chemical based on research studies, accidents, and laboratory experiments. Other reputable scientific journals can also be a source of useful environmental data. These research-based studies can be used to compare Loudon County to other geographic areas.

Analyzing Publicly Available Data

In addition to the above sources of information, the EPA has AirData that can be downloaded and reviewed by anyone. The data is available for many years for several hundred monitoring sites across the United States. The Internet URL is http://www.epa.gov/air/data. The following exercise will use data generated from the AirData for 2003 and 2004 (HAPs data is available for these years). A limited amount of 2005 data has been certified and made available, but without a complete data set comparisons to the previous years' data should not be made.

The data provided has many characteristics including: number of observations, four highest values recorded during the year, mean of all values measured, monitor location, and the reason for the monitor. It is important to note the values presented in the downloadable data. The analytical results are in parts per billion based on carbon (ppbC). The health assessment presented all data in parts per billion by volume (ppbV). To convert, the ppbC value needs to be divided by the number of carbon atoms present in the molecule. Acetaldehyde values need to be divided by 2, formaldehyde, carbon disulfide, and carbon tetrachloride values divided by 1, and benzene values divided by 6. It is important to note the number of observations. In other words, how many measurements of the chemical are contained within the data set. With more observations available the air quality data should be more representative of the average local conditions near the monitoring site. A few monitors measure air parameters frequently and skew the overall observation number upward. This does not affect the quality of the concentration data as the average of the means was used allowing the multiple measurements to only count once in the statistic presented and normalizing the data to follow a normal distribution.

AirData Acetaldehyde

After downloading the data, sorting fields, and performing some simple statistics, a table like the one below can be produced from the EPA UATMP AirData for the chemical acetaldehyde. The table includes the ppbC, converted ppbV, and number of times acetaldehyde was observed. Calendar years 2003 and 2004 are presented. Notice that only 5 values for acetaldehyde are included in the 2003 data for Loudon County. As stated in the health assessment, there is skepticism in the earliest monitoring data for cartridge samples.

Considering all of the data available, the mean value reported for all 45 acetaldehyde measurements at the Loudon County monitor of 1.79 ppb is not that much different than the 1.43 ppb and 1.31 ppb of acetaldehyde measured across the United States in 2003 and 2004, respectively. Furthermore, from the AirData, only the acetaldehyde measurements that were collected for background purposes were considered. The Loudon County HAPs data, collected April 21 through May 22, 2005, had a mean of 1.28 ppb acetaldehyde compared to the annual average background values of 1.75 ppb in 2003 and 1.34 ppb in 2004. The acetaldehyde concentration measured in Loudon County air is not elevated compared to other areas in the United States. Therefore, the health assessment conclusion that no apparent public health hazard from acetaldehyde in air as measured at the HAPs monitor is supported.

Acetaldehyde			
	ppbC	*ppbV*	*# Obs*
Annual average 2003	*2.87*	*1.43*	*11745*
Annual average 2004	*2.62*	*1.31*	*10025*
Loudon mean 2003	*5.68*	*2.84*	*5*
Loudon mean 2004	*3.53*	*1.76*	*31*
Loudon PHA mean		[R] *1.79*	*46*
Loudon PHA ≤Apr 9, 2004		*2.89*	*14*
Loudon PHA >Apr 9, 2004	*2.72*	*1.28*	*32*
Average Backgrounds 2003	*3.50*	*1.75*	[NY] *1037*
Average Backgrounds 2004	*2.67*	*1.34*	[NY] *813*
NY = number of observations includes many measurements from a Queens County New York monitor *R = reported value in the Loudon County HAPs health assessment*			

AirData Carbon Disulfide

According to the Toxic Release Inventory (TRI) data, Loudon County ranks high for carbon disulfide emissions in Tennessee. Viskase is known to use two railcars of carbon disulfide per week. Even though carbon disulfide was not part of the urban air toxics monitoring, it was apparent that measurements of carbon disulfide in Loudon County were important. Nineteen carbon disulfide measurements were collected between March 28, 2004, and June 13, 2005.

The mean carbon disulfide value in Loudon County was 14.4 ppb. This value is higher than the annual averages of 0.35 ppb in 2003 and 0.40 ppb in 2004 reported by sites across the U.S.A. It is likely that the local emissions of carbon disulfide into Loudon County air are elevating the value in comparison to other areas in the United States. The amount of carbon disulfide measured in Loudon County air is still far below the 300 ppb ATSDR health guideline. The no apparent public health hazard conclusion is supported when investigating carbon disulfide using the AirData.

Carbon Disulfide			
	ppbC	ppbV	# Obs
Annual average 2003	0.35	0.35	3399
Annual average 2004	0.40	0.40	2636
Loudon mean 2003	NR	NR	0
Loudon mean 2004	NR	NR	0
Loudon PHA mean	6.2	[R] 6.2	6
Loudon PHA ≤Apr 9, 2004	6.3	6.3	2
Loudon PHA >Apr 9, 2004	6.1	6.1	4
Average Backgrounds 2003	NE	NE	1
Average Backgrounds 2004	NE	NE	2
NE = not enough background samples were collected to determine this value NR = none reported; Loudon monitoring data for carbon disulfide not in AirData R = reported value in the Loudon County HAPs health assessment			

<u>*AirData Formaldehyde*</u>

Formaldehyde is perhaps the most complex HAP discussed in the health assessment. The formaldehyde measurements from the HAPs monitor up to April 9, 2004, averaged 19.8 ppb over 14 observations. This value was above health guidelines. Measurements thereafter were much less. The reason for the change in the data is unknown, though maintenance to the monitor is being considered. The more recent average formaldehyde concentration was 1.84 ppb as measured over 32 observations. This value is less than the annual averages in 2003 of 3.49 ppb and 2004 of 3.39 ppb for all sites reporting to AirData. Sites reporting only background concentrations, had average background formaldehyde concentrations of 3.14 ppb in 2003 and 2.20 ppb in 2004. Recent formaldehyde measurements at the Loudon County HAPs monitor are consistent with normal levels of formaldehyde measured in the U.S.

Formaldehyde			
	ppbC	ppbV	# Obs
Annual Average 2003	3.49	3.49	[C] 17807
Annual Average 2004	3.39	3.39	[C] 18478
Loudon mean 2003	23.36	23.36	5
Loudon mean 2004	6.58	6.58	31
Loudon PHA mean	9.17	[R] 9.17	46
Loudon PHA ≤Apr 9, 2004	19.8	19.8	14
Loudon PHA >Apr 9, 2004	2.07	2.07	32
Average Backgrounds 2003	3.14	3.14	[NY] 972
Average Backgrounds 2004	2.20	2.20	[NY] 786
C = observations include many measurements from a Chicago, Illinois monitor NY = observations include many measurements from Queens County, New York monitor R = reported value in the Loudon County HAPs health assessment			

AirData Benzene

Benzene levels measures in Loudon County air at the HAPs monitor are lower than values reported at other air monitoring sites in the U.S. The annual averages for benzene measured at sites in 2003 and 2004 were a bit higher than in Loudon County. Also, 32 monitoring sites setup for general/background samples in 2003 and 39 sites in 2004 showed slightly higher background levels of benzene in other parts of the U.S.A., supporting the health assessment conclusion of no apparent public health hazard.

Benzene			
	ppbC	ppbV	# Obs
Annual Average 2003	2.53	0.421	121,988
Annual Average 2004	2.43	0.405	125,567
Loudon mean 2003	2.05	0.342	4
Loudon mean 2004	2.24	0.373	31
Loudon PHA mean	2.3	[R] 0.39	48
Average Backgrounds 2003	3.14	0.523	[TX] 3716
Average Backgrounds 2004	2.43	0.406	8,644

TX = observations include many measurements from Port Aurthor, Texas monitor
R = reported value in the Loudon County HAPs health assessment

AirData Carbon Tetrachloride

The reported mean of carbon tetrachloride concentrations measured at the Loudon County HAPs monitor was 0.09 ppb. This is equal to the 2003 annual average of 0.09 ppb and a bit lower than the 2004 annual average of 0.12 ppb reported for other U.S. sites. AirData annual averages for carbon tetrachloride general/background air samples were 0.10 ppb in 2003 and 0.11 pbb in 2004, supporting the conclusion of no apparent health hazard.

Carbon Tetrachloride			
	ppbC	ppbV	# Obs
Annual Average 2003	0.09	0.09	[P] 10,985
Annual Average 2004	0.12	0.12	10,026
Loudon mean 2003	0.06	0.06	4
Loudon mean 2004	0.08	0.08	31
Loudon PHA mean	0.09	[R] 0.09	41
Background 2003	0.10	0.10	1,317
Background 2004	0.11	0.11	1,573

P = observations include many measurements from a Providence, Rhode Island monitor
R = reported value in the Loudon County HAPs health assessment

When the publicly available EPA AirData was downloaded and statistically analyzed, the conclusions for the public release Loudon County Hazardous Air Pollutants Public Health Assessment were supported. In large, Loudon County air is similar to other areas in the U.S.A.

Comment 2:

"The statement, 'Since health endpoints for both chemicals are essentially the same, a safe assumption is that the toxicity of these chemicals may be additive' (referring to formaldehyde and other aldehydes), is generally accepted dogma when data are absent describing multiple chemical effects. However, there are a few references that indicate there is a competitive binding to the trigeminal nerve (common receptor) for formaldehyde, acrolein, and acetaldehyde. So although the additivity assumption may still hold true for more chronic endpoints, it appears not to be the case for acute endpoints."

Other people were concerned that nothing specific was presented about quantifying risks from the mixture of chemicals.

Answer 2:

Several research papers were found addressing the issue of the additivity of health effects from mixtures of formaldehyde and acetaldehyde from inhalation. In the most applicable paper, (Cassee 1996) a measure called the RD50 was used to calculate competition for the trigeminal nerve receptor (site of sensory irritation) of mixtures. The RD50 is a statistically derived concentration which reduces the respiratory rate by 50%. The RD50 for formaldehyde ranges from 4.7 to 13.7 ppm (or 4,700 to 13,700 ppb). When levels of these mixtures are inhaled in the RD50 range, there is competition for the receptor and the total health effect is less than predicted from additivity models. According to the same article, "at concentrations much lower than the RD50, a competition model will result in similar results as predicted by dose-addition of equidoses of each compound." (Cassee 1996). The concentrations of formaldehyde and acetaldehyde ranged from less than 1 ppb to around 3 ppb, respectively, using data since April 9, 2004. These concentrations found in Loudon are well below the RD50. Competition would not be expected for the receptor site. Additive effects would be expected.

In addition to formaldehyde and acetaldehyde, there are other aldehydes and chemicals in the Loudon air that may compete for the trigeminal nerve receptor site. These chemicals are at very low levels, but when mixed together may have a more pronounced health effect. Whether the total effect of the mixture is truly additive or competitive cannot be predicted, but the effect may be greater than effects from any individual HAP.

Comment 3:

More than one commenter confused the public health assessment with an EPA-style risk assessment. The two assessments are very different in format and purpose.

Answer 3:

A risk assessment is an analysis that uses information about toxic substances at a site to estimate a theoretical level of risk for people who might be exposed to these substances, usually over a life-time. Risk assessments, prepared by EPA and other agencies, are used to determine if levels of toxic substances at hazardous waste sites pose an unacceptable risk as defined by regulatory standards and requirements. The risk assessment helps regulatory officials make management decisions, such as hazardous site cleanup strategies that will ensure3 overall protection of human health and the environment.

Risk assessments often are conducted without considering actual exposure. Conservative safety margins are built into a risk assessment analysis to ensure protection of the public for a life-time and for sensitive populations. Therefore, people will not necessarily become sick even if they are exposed to materials at higher dose levels than those estimated by the risk assessment. A risk assessment makes sure all members of the public will be protected from a theoretical risk.

While a public health assessment does not measure the actual health effects that hazardous substances have on people, the assessment does consider actual past, present, or future exposures. The health assessor reviews site-related environmental data and detailed toxicological information about substances at a site or, in the case of Loudon County, about the HAPs measured at the monitor. The assessor derives an estimated dose of the substances to which people in the community might be exposed (concentrations of HAPs at the monitor for Loudon); then these doses are compared with health comparison values (regulatory standards, ATSDR guidelines, WHO guidelines, etc.). Even if the exposure levels are greater than health comparison values, a public health hazard does not necessarily exist. The mechanism of action of the chemicals, dose-response relationships, data from human epidemiologic studies, how people are exposed, and the length and frequency of exposure are all considered in making a determination about hazard to public health from actual or potential exposures.

Since a public health assessment is not an analytical epidemiologic study, usually no relationships can be established between exposure data and health outcome data. In Loudon County, some signs of upper respiratory irritation were found that could possibly have a relationship to mixtures of chemicals, especially aldehydes, but because public health assessments are not designed to show causation, EEP cannot say that the mixture of chemicals measured at the HAPs monitor caused the upper respiratory irritation. The conclusions of an assessment, which are based on the professional knowledge and judgment of the health assessment team, address the likelihood that persons living near a site with hazardous substances were exposed, are being exposed, or might be exposed at some future time to harmful levels of hazardous substances from the site.

Health outcome data are used to give a snap-shot of the health of the community using datasets that are available. No new health data are generated, as would happen in an epidemiologic study. Because the environmental data and the existing health outcome data do not usually overlap in time and no personal exposures are known, causation cannot be established.

A health assessment draws conclusions about exposures to toxic substances and whether the *exposures are likely to lead to illness. Recommendations are made about ways to protect public health. For example, recommendations might be made for the elimination or reduction of harmful exposures, or that some critical, missing data is obtained to assist the evaluation. It could also recommend a more rigorous health investigation be conducted.*

The public health assessment is neither a medical evaluation of individuals nor a rigorous health study of populations (an analytical epidemiology study). It is not a statement about establishing or meeting regulatory standards. The assessor does not determine cleanup levels or the best methods for cleanup or treatment. The public health assessment can be used by risk managers, along with other reports and research, to make decisions. The purpose of the public health assessment is not to make management decisions or to draw conclusions in the absence of data. A risk assessment investigates and evaluates the theoretical effects of hazardous waste both on people and the environment for regulatory purposes. A public health assessment only considers effects to people for public health purposes.

Comment 4:

Use of non-cancer guidelines is not an appropriate basis for an analysis of total risk which includes cancer risk as well as non-cancer risk.

Answer 4:

The reasons for using the non-cancer guidelines is discussed in detail in the Discussion section for acetaldehyde and formaldehyde. Both acetaldehyde and formaldehyde seem to cause cancer at much higher levels than those measured at the HAPs monitor. The concentrations at which a promoter of cancer would enhance carcinogenicity of another chemical would be at least as large as the threshold cancer risk concentrations (tolerable concentration). The World Health Organization's tolerable concentration for acetaldehyde is 0.3 mg/m^3 (167 ppb), and its guideline for formaldehyde in ambient air is 0.1 mg/m^3 (81 ppb), as compared to the average concentration of 1.84 ppb measured after April 9, 2004.

Comment 5:

"Use of generalized anecdotal assertions, instead of available, empirical data, is not appropriate documentation for risk or exposure levels to children and the elderly."

Answer 5:

EEP examined toxicological data and literature for children and the elderly for HAPs; unfortunately not much age-specific data is available. EEP believes that its conclusions about no apparent health hazard for acetaldehyde, formaldehyde, benzene, carbon tetrachloride, and carbon disulfide are applicable for all people of all ages.

Comment 6:

"The mission statement of the TN Dept of Health states it is charged with protecting the health of the public. . . Loudon County is ranked 1st in overall cancer rate in TN . . . When can we expect this protection to begin?"

Answer 6:

Before this public health assessment was performed, no one knew that Loudon County's cancer incidence rate was #1 for the mean rate for all cancers combined for both sexes during the years 1991-2000. Before anything can be done to lower the rate, the causes must be determined. After the causes are identified, then a plan can be made and implemented to help lower cancer incidence rates. We have already begun to look into identifying the many possible causes of cancer in Loudon County.

Comment 7:

"The statement, 'A person's exposure depends on the concentration within a location (microenvironment) and how long a person spends in each microenvironment' is correct. The preceding sentence, 'Actual exposure (often called the dose) is principally defined by the concentration to which the individual is exposed' is redundant (and not as well-stated), and should be deleted. The following sentence, 'This report will examine the inhalation route of exposure in detail' is not accurate (and also belated, coming after the main analyses). As no exposure assessment was performed, this sentence should be deleted."

Answer 7:

The first part of the comment deals with writing style. The paragraph will essentially remain as written. The main analysis begins in the discussion. The preceding section laid out the background for analysis and discussion. The format is specified by ATSDR. As stated in the answer about the differences in risk assessment and health assessments, this report is about hazardous air pollutants and the likelihood of them causing a public health hazard through the inhalation route of exposure. As the comment states, no exposure assessment was done. However, a detailed analysis of the inhalation exposure pathway and likelihood of a public health hazard was indeed performed.

Comment 8:

"Franklin County is comparable to Loudon County in several important respects, but this table omits an important difference: the percentage of residents in older age groups, who are at much greater risk of being diagnosed with aging-related diseases such as cancer, is higher in Loudon County than in Franklin County. According to the National Cancer Institute's State Cancer Profiles, Loudon County ranks 7th in Tennessee in percent of residents older than 50, while Franklin County ranks 36th.

Other commenters want to know if Loudon and Franklin Counties have comparable growth rates and if the growth rate in Loudon County (especially among older retirees) is skewing the analysis of health outcome data.

Answer 8:

According to the 2000 census, at that time, the age distributions of Loudon and Franklin Counties matched very well: 13.2% in Loudon County versus 12.8% in Franklin County for people aged 65 to 84 and 1.4% versus 1.5% for people aged 85+. For statistical comparisons this is an excellent match. The 2005 population projections from TDH show that 7,456 (17.9%) people aged 65 to greater than 85 years are expected to live in Loudon County compared to 6,241 (15.3%) in Franklin County. It can be seen that both counties are increasing in the proportion of older people. These numbers are population estimates. Health outcome data used in the public health assessment included only the early 2000s, with the cancer data ending with the year 2000. No health data for 2004 or 2005 was available for review. As people move into Loudon County it is possible that older people are making up a larger portion of the population. That is one of the topics EEP wants to investigate further.

The idea of comparing growth rate differences between the comparison counties is very good. That can certainly be a part of our next steps is trying to find out why the cancer incidence rates in Loudon County are higher.

Comment 9:

Several people commented on the lack of age-adjustment of health data and the differences in crude and mean rates.

Answer 9:

Please Appendix H for a detailed discussion of methodology and age-adjustment.

The draft Loudon Public Health Assessment released for public comment included mean disease rates for all years in which data was available. The reason for this was to address the community question: Do the disease rates for Loudon County differ significantly over time when compared to Franklin County and the State of Tennessee? Given the data limitations, the statistical method that most appropriately targets this question is the student t-test where variance among annual rates is taken into account. This method calculates a mean rate from annual disease rates and compares how annual disease rates differ from the mean. It also calculates a p-value to indicate how significant differences are from the mean. The data available for such analyses at that time consisted of:

1. *death certificate information from 1990 through 2003,*
2. *in-patient hospital discharge data from 1997 through 2002 and provisional data for 2003;*
3. *out-patient hospital discharge data from 1998 through 2001; and*
4. *Tennessee Cancer Registry (TCR) incidence case data from 1991 through 2000. The formula used to calculation mean rates is:*

$$Mean = \left[\sum\left(\frac{Number\ of\ Events\ in\ Specific\ Year}{Population\ for\ Specific\ Year} \times 100{,}000\right)\right] \div Number\ of\ Years$$

From comments received at the public meeting and during the comment period, two other questions arose about the health data. The first question was: Relatively speaking, how does the health experience differ between Loudon County, Franklin County and the state of Tennessee? While this seems similar to the initial question raised, it is less concerned with change over time and more interested in broader, big picture, difference. The second question was: Why were mean rates instead of crude rates used? Crude rates can sometimes be more sensitive to changes in population structure than mean rates so in response to these questions we have added crude rates to the final report. We also added relative risk ratios (more properly referred to as rate ratios under these circumstances) to the final analyses. The formulas used for these tasks are:

$$Crude\ Rate = \frac{Total\ Number\ of\ Events\ for\ all\ Years}{Total\ Population\ for\ all\ Years} \times 100{,}000$$

$$Rate\ Ratio = \frac{\dfrac{Total\ Number\ of\ Events\ for\ all\ Years\ for\ Area\ 1}{(Total\ Population\ for\ all\ Years\ for\ Area\ 1) - (Total\ Number\ of\ Events\ for\ all\ Years\ for\ Area\ 1)}}{\dfrac{Total\ Number\ of\ Events\ for\ all\ Years\ for\ Area\ 2}{(Total\ Population\ for\ all\ Years\ for\ Area\ 2) - (Total\ Number\ of\ Events\ for\ all\ Years\ for\ Area\ 2)}}$$

Additional data became available during the editing of the final report. Data analyzed for the final report consisted of:

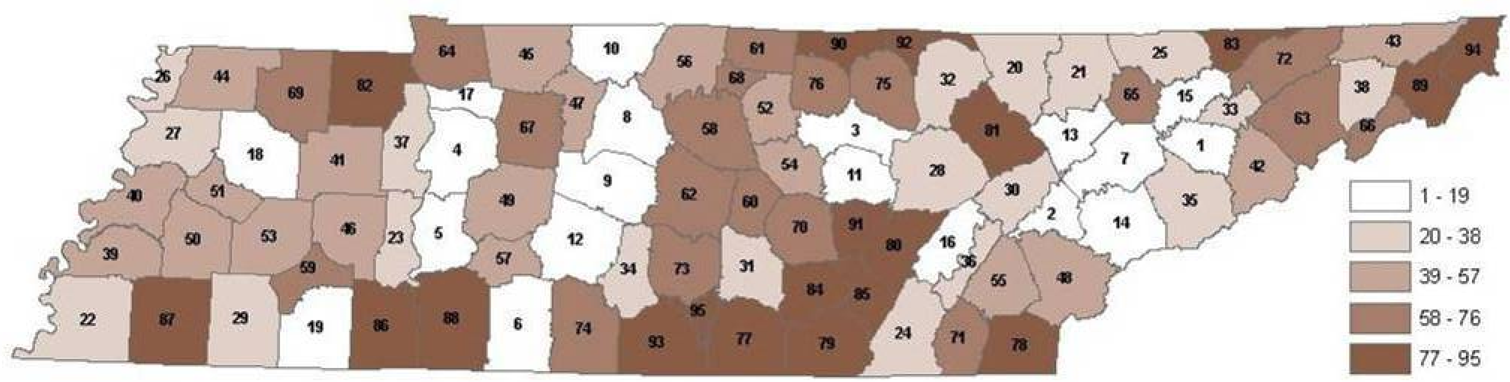
1. *death certificate information from 1990 through 2003;*
2. *inpatient hospital discharge data from 1997 through 2003 (final for all years);*
3. *outpatient hospital discharge data from 1998 through 2003 with 2003 data being provisional; and*
4. *Tennessee Cancer Registry (TCR) incidence case data from 1991 through 2000.*

However, since rates for all cancers ranked Loudon County as the highest in Tennessee with respect to mean rates and second highest with respect to crude ranks, we compared ranked age-adjusted cancer rates for all counties in Tennessee. The additional formula used to calculate age-adjusted rates is:

$$Age\text{-}Adjusted\ Rate = \sum\left[Age\ Proportion\left(\frac{Total\ Number\ of\ Events\ for\ all\ Years\ for\ Specific\ Age\ Group}{Total\ Population\ for\ all\ Years\ for\ Specifc\ Age\ Group} \times 100{,}000\right)\right]$$

The age groups and corresponding proportions used for this formula and used by the Tennessee Department of Health, Office of Policy, Planning and Assessment, routinely, are:		
Age Group	*Age Range, Years*	*US 2000 Population*
1	*< 1*	*0.013818*
2	*1-4*	*0.055317*
3	*5-14*	*0.145565*
4	*15-24*	*0.138646*
5	*25-34*	*0.135573*
6	*35-44*	*0.162613*
7	*45-54*	*0.134834*
8	*55-64*	*0.087247*
9	*65-74*	*0.066037*
10	*75-84*	*0.044842*
11	*≥ 85*	*0.15508*

Total TCRI Cases Ranked by Age-Adjusted Rate



ALL CANCERS TOTAL TCRI CASES 1991-2000

County	Rank	Number	Age-adjusted Rate
Jefferson	1	1907	462.17 (441.43-482.92)
Loudon	2	1985	460.42 (440.16-480.67)
Putnam	3	2659	456.72 (439.36-474.08)
Humphreys	4	881	455.31 (425.24-485.37)
Perry	5	389	446.18 (401.84-490.51)
Lawrence	6	1823	441.21 (420.95-461.46)
Knox	7	16062	440.17 (433.36-446.98)
Davidson	8	22084	439.40 (433.61-445.2)
Williamson	9	3582	434.97 (420.73-449.22)
Robertson	10	1935	430.78 (411.59-449.98)
White	11	1056	420.67 (395.29-446.04)
Maury	12	1156	420.56 (396.31-444.8)
Anderson	13	3522	417.08 (403.3-430.85)
Blount	14	4442	414.65 (402.45-426.84)
Grainger	15	825	414.65 (386.36-442.95)
Rhea	16	1192	414.57 (391.03-438.1)
Houston	17	389	414.04 (372.89-455.19)
Gibson	18	2423	413.29 (396.84-429.75)
McNairy	19	2620	413.02 (397.2-428.83)
Scott	20	782	412.19 (383.3-441.08)
Campbell	21	1754	411.90 (392.62-431.17)
Shelby	22	30310	411.26 (406.63-415.89)
Decatur	23	599	411.11 (378.18-444.03)
Hamilton	24	13014	410.75 (403.69-417.81)
Claiborne	25	1207	409.48 (386.38-432.58)
Lake	26	326	406.15 (362.06-450.24)
Dyer	27	1550	405.04 (384.87-425.2)
Cumberland	28	2302	402.32 (385.88-418.75)
Hardeman	29	1063	401.75 (377.6-425.9)
Roane	30	2395	401.68 (385.59-417.77)
Coffee	31	1963	401.15 (383.41-418.9)
Fentress	32	676	400.80 (370.59-431.02)
Hamblen	33	2288	398.02 (381.71-414.33)
Marshall	34	3343	397.58 (384.1-411.06)
Sevier	35	2601	397.04 (381.78-412.3)
Meigs	36	396	396.93 (357.83-436.02)
Benton	37	803	395.62 (368.25-422.98)
Washington	38	4222	391.99 (380.16-403.81)
Tipton	39	1526	391.37 (371.74-411.01)
Lauderdale	40	995	390.29 (366.03-414.54)
Carroll	41	1359	390.21 (369.46-410.95)
Cocke	42	1318	389.02 (368.02-410.02)
Sullivan	43	6755	386.96 (377.73-396.18)
Obion	44	1415	386.75 (366.6-406.9)
Montgomery	45	3195	385.13 (371.78-398.49)
Henderson	46	999	381.49 (357.84-405.15)
Cheatham	47	975	381.19 (357.26-405.12)
Monroe	48	1401	380.46 (360.53-400.38)
Hickman	49	765	378.98 (352.12-405.83)
Haywood	50	781	378.72 (352.16-405.28)
Crockett	51	629	378.33 (348.76-407.9)
Smith	52	643	373.19 (344.34-402.03)
Madison	53	1036	372.98 (350.27-395.69)
DeKalb	54	682	371.53 (343.65-399.42)
McMinn	55	943	370.15 (346.53-393.78)
Sumner	56	4020	369.70 (358.27-381.13)
Lewis	57	419	368.36 (333.09-403.64)
Wilson	58	2546	365.34 (351.15-379.53)
Chester	59	535	364.05 (333.2-394.9)
Cannon	60	466	362.35 (329.45-395.25)
Macon	61	1839	362.20 (345.64-378.75)
Rutherford	62	4067	362.02 (350.89-373.15)
Greene	63	2415	360.75 (346.37-375.14)
Stewart	64	473	359.53 (327.13-391.94)
Union	65	519	354.61 (324.11-385.12)
Unicoi	66	774	353.18 (328.3-378.06)
Dickson	67	1349	352.76 (333.93-371.58)
Trousdale	68	259	351.96 (309.09-394.82)
Weakley	69	1280	351.81 (332.54-371.09)
Warren	70	1351	348.05 (329.49-366.61)
Bradley	71	2690	340.27 (327.41-353.13)
Hawkins	72	1800	339.69 (323.99-355.38)
Bedford	73	1217	339.30 (320.24-358.37)
Giles	74	1067	337.28 (317.04-357.51)
Overton	75	734	334.14 (309.97-358.32)
Jackson	76	402	332.31 (299.83-364.8)
Franklin	77	1392	331.27 (313.86-348.67)
Polk	78	548	326.96 (299.58-354.34)
Marion	79	615	325.69 (299.95-351.43)
Bledsoe	80	351	324.45 (290.51-358.4)
Morgan	81	579	319.98 (293.91-346.04)
Henry	82	1235	318.93 (301.14-336.71)
Hancock	83	235	310.16 (270.51-349.82)
Grundy	84	454	306.81 (278.59-335.03)
Sequatchie	85	312	304.78 (270.96-338.6)
Hardin	86	871	303.24 (283.1-323.38)
Fayette	87	826	300.59 (280.09-321.09)
Wayne	88	505	293.53 (267.93-319.13)
Carter	89	1737	278.57 (265.47-291.67)
Clay	90	252	277.59 (243.32-311.86)
Van Buren	91	145	255.15 (213.62-296.68)
Pickett	92	140	234.56 (195.71-273.41)
Lincoln	93	748	218.94 (203.25-234.63)
Johnson	94	409	213.50 (192.81-234.19)
Moore	95	106	173.99 (140.86-207.11)
Tennessee	96	209625	394.93 (393.24-396.62)

Comment 10:

"As mentioned previously, the cancer incidence data quoted here could not be verified on the TCR website. Age-adjusted cancer incidence data by primary site in Loudon County (1997-2000 data) indicated that prostate cancer has the highest incidence, although it can obviously occur only in men. Brain cancer is not in the top ten cancer sites. Breast (not ovary) is the leading cancer site for women.

Answer 10:

EEP used both the TCR website (1997-2000) and the raw data (1990 – 2000) in this public health assessment. Analysis of more years of data would be expected to change details of the rankings. All use of the health data was checked by the Office of Policy, Planning and Assessment and found to be correct.

Comment 11:

Several comments referred to the problems with the HAPs monitor leading to the conclusion that the HAPs data is unreliable.

Answer 11:

The Division of Air Pollution Control (APC) was very open about the initial problem with the acetonitrile leaking from a component of the cartridge into the canister portion of the monitor. This was discussed briefly in the Discussion section. APC sought the aid of the U.S. EPA and the manufacturer of the monitor in finding the cause of the problem and in solving it. Shortly after solving the acetonitrile problem, the concentrations of formaldehyde and acetaldehyde dropped. The concentrations of some other HAPs, also, dropped, but not as dramatically. Again, APC has sought the aid of the U.S. EPA and the manufacturer. Although no one knows precisely why the concentrations dropped and stayed at the lower values, APC believes that the initial formaldehyde and acetaldehyde data is questionable. APC, the U.S. EPA, and TDH believe that the later monitoring is accurate.

Comment 12:

Several people commented that the public health assessment did not adequately address children and sensitive populations.

Answer 12:

EEP discussed the toxicity of the chemicals of concern as related to sensitive populations as adequately as possible, given the state of current toxicologic knowledge. It is impossible to consider individuals and their particular risks in this type of assessment. EEP tried to find information about toxic and reproductive effects on sensitive groups in order to draw conclusions valid for these sensitive groups. See the discussions of formaldehyde, benzene, and carbon disulfide.

Even though children were not specifically mentioned in the conclusions, the conclusions are valid for children and everyone else. Benzene measured at the monitor is at extremely low concentrations, so it is highly unlikely to cause any health effects to anyone in Loudon County. The same conclusion is applicable to acetaldehyde. Although evidence suggests that acetaldehyde may act as a promoter of cancer, the extremely low concentrations found in Loudon County make it highly unlikely that the acetaldehyde in ambient air could act as a promoter or an initiator of cancer.

Comment 13:

At the Open House, members of APC did not make themselves available.

Answer 13:

EEP is sorry that you felt that way. The Open House lasted from before 9:00 AM until after 7:00 PM. APC staff were present and available during the entire time. Toward the end of the day, when they were sitting down, they may have given the impression they were having a meeting, but they were not. Other members of the community complemented the good access to APC staff.

Comment 14:

Some people could not find the document on the TDH website.

Answer 14:

EEP is sorry to hear that you could not find the document on the TDH Internet site. We are glad that you told us. In the future, we will try to make Internet use easier and will explain to staff who answer the main telephone how to help people access our documents.

Comment 15:

Several people were concerned:

- that the only way a true assessment can be made on the environment in Loudon County, is to engage a third party, independent of the government to perform a study to ascertain what pollutants are involved and where they are coming from,
- only 2 out of 6 staff have a Ph.D. in the appropriate fields, and
- one year to write the public health assessment is excessive.

Answer 15:

EEP is sorry that community members feel this way. EEP staff are experts in their various fields, with four Master's of Science degrees, one Ph.D., and two professional certifications among the five staff members. They are qualified for this work. EEP did not want to take a whole year to write this public health assessment. However, given the complexity of the site and *the many community needs, it took EEP longer than expected to produce the public health assessment.*

We understand some people do not trust government. Although the EEP staff was qualified to perform the assessment, EEP would be responsive to a third party performing an assessment.

Comment 16:

Several people were concerned with air pollution in Lenoir City. Others were concerned about air pollution from all the cars and trucks on the many high ways in Loudon County.

Several commenters wanted to know HAPs levels in other parts of Loudon County and wanted to know why there was only one HAPs monitor.

Answer 16:

The HAPs monitoring program across the U.S.A. is the first time that hazardous air pollutants have been measured consistently over time and space. While it is difficult to draw conclusions about health effects in a county from one monitor, it is a very good first step to have the monitor. EEP hopes that the HAPs monitoring program will grow, eventually becoming routine and less expensive so that better estimates of health risk can be made and better decisions to protect public health can be made. EEP agrees that it is a good idea to do some air sampling where traffic is heavy. An additional HAPs monitor in Loudon County would be helpful.

Comment 17:

"We would like to know the link between hazardous air pollutants, toxins in the environment, and the health of residents in Loudon County."

Answer 17:

As stated in the document under the Purpose, Discussion, Health Implications, and Conclusions sections, no associations between the HAPs and health outcome data can be drawn. The HAPs data and the health outcome data come from different time periods. A well-designed analytical epidemiologic would be necessary to show causation between exposures and health effects. In Loudon we do not have individual exposure data, which would be necessary before trying to show cause-and-effect; nor do we have evidence of exposures that would lead to adverse health effects of a magnitude that would be identifiable by epidemiologic studies. To obtain funding for a study (estimated in excess of $1,000,000), a very high likelihood of adverse health effects from exposures would be necessary.

Comment 18:

Please name all sources of facts and emissions data used in this draft copy.

Answer 18:

All data from the HAPs monitor came from the Division of Air Pollution Control, Tennessee Department of Environment and Conservation. All health outcome data came from the Office of Policy, Planning and Assessment, Tennessee Department of Health. All facts and data are explicitly referenced in the report, with details of the source in the References Section. Also, please refer to the Comment and Answer #1.

Comment 19:

How were TDEC and DuPont involved in the public health assessment? Who else was involved?

Answer 19:

TDEC APC asked EEP to do the public health assessment. They asked for an interpretation of the HAPs data they were collecting and if the chemicals measured could cause adverse health effects. APC provided the data for HAPs, particulates, ozone, and carbon disulfide. They also provided us access to the air modeling done by the University of Tennessee and to the APC files. Other divisions with TDEC, also, provided EEP with access to their files. TDEC commented on the draft document just like everyone else. EEP asked APC to be available at the open house because many people had detailed questions that only APC could answer.

EEP did not ask DuPont to participate in the public health assessment process. DuPont participated in the same way as the rest of the community. They were welcome at the open house, and they sent in comments during the comment period. They chose to bring their comments to us so that they could explain them.

Other members of the Loudon County community asked to meet face-to-face with EEP (in Nashville) and did.

EEP talked with Dr. Guider, a concerned local pediatrician, and with school nurses, at the suggestion of the community.

EEP asked the Office of Policy, Planning and Assessment to provide health outcome data. They did so, and the data was analyzed using SAS computer software.

No one has or has attempted to unduly influence the report. EEP has written a public health assessment that is accurate and truthful.

Comment 20:

Some commenters wanted to know why the public health assessment did not address the use of coal by area industries and the releases of mercury and sulfur dioxide from burning coal.

Answer 20:

The purpose of the public health assessment was to look at the data on HAPs and draw conclusions about the likelihood of public health hazards from exposure to the HAPs. We have no data on the amount of mercury and sulfur dioxide released in Loudon County to provide any health-based conclusions.

Comment 21:

"Please address the collective concentrations of toxic (hazardous air pollutants) found in Loudon County's ambient air that are also found cigarette smoke."

One person commented that he is dying from lung cancer and believes that the industrial pollution is the cause of the cancer; he has not smoked for more than 50 years.

Answer 21:

An explanation of cigarette smoke was provided with the toxicity of the various chemicals in the Discussion section. Cigarette smoke contains about 4000 chemicals and more than 20 – 60 carcinogenic chemicals. If a pack of cigarettes is smoked by 5 people in 30 minutes in a room 14 feet on each side and 8 feet tall, the resulting concentration of formaldehyde in the room air will be about 330 µg/m^3 (approximately 270 ppb) (WHO 1989). This represents a level more than 100 times the formaldehyde found at the HAPs monitor.

Another way to make comparisons is to consider the worst case scenario used in the public health assessment – a person stands by the monitor 24 hours a day, seven days a week for 70 years. This exposure to formaldehyde would be on the order of 57 µg of formaldehyde per day. A person who smoked a pack of cigarettes each day would be exposed to about 1,000 µg of formaldehyde per day (WHO 1989). There is less quantitative information available about concentrations of other chemicals in cigarettes. But this comparison with formaldehyde indicates that the exposures at the monitor in Loudon County are much less than exposures from smoking. In addition, inside air contains more formaldehyde than outside air due to sources such as particle board, gas stoves, kerosene heaters, household products, and environmental tobacco smoke. It has been estimated that Americans spend about 10% of our time outside and about 65% of our time in our homes.

The toxicity of a chemical is dependent upon the amount of the chemical to which a person is exposed, how often he is exposed, and the amount of time of the exposure. For instance, pharmaceuticals (such as aspirin) have no effect at very low doses (say a tenth of a baby aspirin each day for an adult), has a metabolic effect at low doses (one baby aspirin each day), can ease aches and pains at a higher dose (2 regular strength aspirin), and can kill people at still higher doses (a whole bottle taken a one time). HAPs function the same way. Even though formaldehyde and acetaldehyde are classified as probable or possible carcinogens, review of human epidemiology and animal studies strongly indicate that those chemicals have a threshold – a level with no effects for carcinogenic activity and non-cancer activity. So it is not only *possible, but likely, that the low levels of chemicals found at the monitor are without adverse health effect. But the same chemicals at much higher doses, as in cigarettes, can be harmful.*

While the staff of EEP are concerned about anyone having cancer, it is impossible for us to determine definitively what caused any one person's cancer.

A commenter noted that CDC considers the east Tennessee Region to have a high rate of smoking. The CDC study quoted (MMWR 2001) did not include Loudon County. CDC does not have sufficient Loudon County smoking data to make any rate adjustments for smoking.

Comment 22:

Why did the public health assessment ignore residential neighborhoods close to Blair Bend Industrial Park? Why did the assessment discuss issues in Tellico Village and not for other retirees in Loudon County? Why did the health assessment assume that everyone in Loudon County has an air conditioner?

Answer 22:

EEP did not ignore the closer neighborhoods. There was discussion of acetaldehyde in the area of the downtown schools. EEP used results of the air modeling for acetaldehyde done by UT. It would have been better to have actual measurements elsewhere in the community, but the only real data EEP had was from the HAPs monitor.

EEP discussed odors in Tellico Village because community members asked us about odors there. Since other areas of Loudon are closer to the schools, EEP assumes that odors could be detected there when the wind blows that way.

EEP did not intentionally ignore other areas of Loudon County. Since EEP only had the data from one monitor and air modeling by U.T. to use, it is not possible to make more than general statements about HAPs in parts of Loudon away from the monitor. In general, the closer to the monitor people live or work, the closer the concentrations of HAPs they are exposed to will match the monitoring data. EEP did not mean to imply that everyone has air conditioning, but for those who do, using the proper filter and changing it on schedule can help them with indoor air pollution.

Comment 23:

Why didn't TDH recommend supervised testing to better define the odorous emissions and their potential health effects?

Answer 23:

APC is working to define odors in a regulatory manner. Area industries are putting controls in place to lower emissions, which should also lower odors. Odors are often present at *concentrations much lower than what is thought to be cause adverse health effects. EEP did suggest that odors can affect the quality of life.*

Comment 24:

Does exposure to acetaldehyde cause larynx cancer and/or tumors of the vocal cords?

Answer 24:

Studies in rats did not show any increase in tumors, except for nasal tumors when the rats were exposed to 1,350,000 µg/m^3 (750,170 ppb) or more acetaldehyde. In Syrian golden hamsters, which inhaled 4,500,000 µg/m^3 (2,500,568 ppb) acetaldehyde at nine weeks with the concentration gradually decreasing to 2,970,000 µg/m^3 (1,650,375 ppb) at 52 weeks, an increase in laryngeal tumors after a 29 week recovery period was observed. In another Syrian golden hamster experiment, the hamsters inhaled 2,700,000 µg/m^3 (1,500,341 ppb) of acetaldehyde seven hours a day, 5 days a week for 52 weeks, and then were given a 26-week recovery period. There were no tumors of the respiratory tract (includes the nose and trachea) in exposed animals. Animals recovered from all lesions in the nasal epithelium during the recovery period (WHO 1995).

While acetaldehyde may cause laryngeal tumors in hamsters at very high doses, it seems that there is a threshold below which tumors do not form. The World Health Organization has recommended guidelines for air for both threshold and non-threshold assumptions. Both recommendations are above the levels of formaldehyde found in Loudon County.

Comment 25:

Several people commented that the mixture of chemicals must have an effect on cancer rates and cause other health problems. They were also concerned that Loudon County was ranked number 1 for cancer incidence in Tennessee.

Answer 25:

The HAPs measured were at very low levels, below levels of concern. While each individual chemical is highly unlikely to cause adverse health effects, much less is known about a mixture of them. The conclusion that there is an indeterminant health hazard from the mixture of pollutants is warranted. We cannot say that mixture has or will cause a public health hazard nor can we say that the mixture has not or will not cause a public health hazard. We do not know.

In addition, EEP will continue to try to find the causes of the high cancer incidence rates in Loudon County. EEP is currently looking more closely at the rates and at other factors that could influence the rates.

In EEP's cancer ranking comparison, Loudon County was ranked number 1 for new cases of cancer occurring. Loudon was not significantly different from the other top counties in cancer incidence. It is likely that in rankings of counties in different years, the numerical ranking would *change. So it is appropriate to think of Loudon County as one of the worst counties for cancer incidence rates, but, not necessarily the worst.*

Comments 26:

One commenter was concerned that the report addressed hospitalization rates for asthma, rather than the incidence of asthma.

Answer 26:

EEP also would like to know the incidence rate of asthma in Loudon County. Unfortunately, no one keeps records of how many people have asthma and are not hospitalized. The only information EEP had about asthma rates was from hospitalization records. EEP hopes that in the future, there will be ways to find the number of people who have been diagnosed with asthma, but did not go to the hospital.

Comment 27:

"Is the odor harmful, yes or no?"

Answer 27:

No, the odor itself is not harmful, but the odor can have an adverse effect on the quality of life, making it uncomfortable to be outside.

Comment 28:

TDEC granted a construction permit to Tate & Lyle / DuPont for a facility which will add well over 400 tons of additional pollution each year. TDEC needs to reduce, not increase, air pollution in Loudon County.

Answer 28:

This comment is beyond the scope of this public health assessment. However, a recent article in the Maryville Daily Times stated that Tate & Lyle expects a 50% reduction in allowable emissions, an 80% reduction in allowable volatile organic compound emissions, and a 67% reduction in acetaldehyde emissions (Pierce 2005).

Comment 29:

"Sulfur dioxide emissions that contribute to $PM_{2.5}$ levels have not been sufficiently addressed."

Answer 29:

The main purpose of this public health assessment was to examine the HAPs data and to discuss the likelihood of the HAPs causing adverse health effects. Some discussion of particulate matter *was necessary, however. No one knows yet if Loudon County will be out of compliance with* $PM_{2.5}$ *standards, since three years of data is not available to determine compliance. Local, state, and federal environmental agencies are responsible for seeing that sulfur dioxide and particulate emissions are meeting all applicable standards.*

Comment 30:

The charge to EEP was to discuss the health impact of HAPs measured at the special monitor and to try to understand the HAPs' impact on public health. There were many comments and questions that were beyond the scope of the public health assessment. These are:

- in-depth discussion of area sewage treatment plants
- emissions from smoke-stacks other than the HAPs
- RCRA sites in Lenoir City
- burning bans
- vehicle emissions testing
- finding the source of PCB in the sediments of the Tennessee River system
- finding local solutions to air pollution
- defining levels of air pollution at which outdoor workers should stop working
- compliance with air regulations
- safety issues (see Community Concern #14: Loudon's future, Appendix I Community Concerns for a discussion of safety issues at industrial facilities)
- policy issues at the state and federal level

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Appendix K

Glossary of Terms

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Absorption
The process of taking in. For a person or an animal, absorption is the process of a substance getting into the body through the eyes, skin, stomach, intestines, or lungs.

Acute
Occurring over a short time [compare with chronic].

Acute exposure
Contact with a substance that occurs once or for only a short time (up to 14 days) [compare with intermediate duration exposure and chronic exposure].

Additive effect
A biologic response to exposure to multiple substances that equals the sum of responses of all the individual substances added together [compare with antagonistic effect and synergistic effect].

Adverse health effect
A change in body function or cell structure that might lead to disease or health problems.

Age-adjusted rate
A measure of the overall burden of a disease in a population that considers the impact of age and is derived by the formula:

$$Age\text{-}Adjusted\ Rate = \sum \left[Age\ Proportion \left(\frac{Total\ Number\ of\ Events\ for\ all\ Years\ for\ Specific\ Age\ Group}{Total\ Population\ for\ all\ Years\ for\ Specifc\ Age\ Group} \times 100{,}000 \right) \right]$$

The age groups and corresponding proportions used for this formula and used by the Tennessee Department of Health, Division of Health Statistics routinely, are:

AGE GROUP	AGE RANGE	US 2000 proportion
12	Less than 1	0.013818
13	1-4	0.055317
14	5-14	0.145565
15	15-24	0.138646
16	25-34	0.135573
17	35-44	0.162613
18	45-54	0.134834
19	55-64	0.087247
20	65-74	0.066037
21	75-84	0.044842
22	85 and older	0.015508

Ambient
Surrounding (for example, *ambient* air).

Analytic epidemiologic study
A study that evaluates the association between exposure to hazardous substances and disease by testing scientific hypotheses.

Antagonistic effect
A biologic response to exposure to multiple substances that is **less** than would be expected if the known effects of the individual substances were added together [compare with additive effect and synergistic effect].

Attainment area
A geographic area in which levels of a criteria air pollutant meet the health-based primary standard (national ambient air quality standard, or NAAQS) for the pollutant. An area may have on acceptable level for one criteria air pollutant, but may have unacceptable levels for others. Thus, an area could be both attainment and nonattainment at the same time. Attainment areas are defined using federal pollutant limits set by EPA.

Background level
An average or expected amount of a substance or radioactive material in a specific environment, or typical amounts of substances that occur naturally in an environment.

Biologic monitoring
Measuring hazardous substances in biologic materials (such as blood, hair, urine, or breath) to determine whether exposure has occurred. A blood test for lead is an example of biologic.

Body burden
The total amount of a substance in the body. Some substances build up in the body because they are stored in fat or bone or because they leave the body very slowly.

Cancer
Any one of a group of diseases that occur when cells in the body become abnormal and grow or multiply out of control.

Cancer risk
A theoretical risk for getting cancer if exposed to a substance every day for 70 years (a lifetime exposure). The true risk might be lower.

Carcinogen
A substance that causes cancer.

Case study
A medical or epidemiologic evaluation of one person or a small group of people to gather information about specific health conditions and past exposures.

Case-control study
A study that compares exposures of people who have a disease or condition (cases) with people who do not have the disease or condition (controls). Exposures that are more common among the cases may be considered as possible risk factors for the disease.

CAS registry number
A unique number assigned to a substance or mixture by the American Chemical Society Abstracts Service.

Causal
Of, relating to, or constituting a cause; for instance, the *causal* agent of a disease

Central nervous system
The part of the nervous system that consists of the brain and the spinal cord.

CERCLA [see Comprehensive Environmental Response, Compensation, and Liability Act of 1980]

Chronic
Occurring over a long time [compare with acute].

Chronic exposure
Contact with a substance that occurs over a long time (more than 1 year) [compare with acute exposure and intermediate duration exposure]

Cluster investigation
A review of an unusual number, real or perceived, of health events (for example, reports of cancer) grouped together in time and location. Cluster investigations are designed to confirm case reports; determine whether they represent an unusual disease occurrence; and, if possible, explore possible causes and contributing environmental factors.

Comparison value (CV)
Calculated concentration of a substance in air, water, food, or soil that is unlikely to cause harmful (adverse) health effects in exposed people. The CV is used as a screening level during the public health assessment process. Substances found in amounts greater than their CVs might be selected for further evaluation in the public health assessment process.

Complete carcinogen
A complete carcinogen is a chemical that has both initiator and promotion properties.

Completed exposure pathway [see exposure pathway].

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)
CERCLA, also known as Superfund, is the federal law that concerns the removal or cleanup of hazardous substances in the environment and at hazardous waste sites. ATSDR, which was created by CERCLA, is responsible for assessing health issues and supporting public health activities related to hazardous waste sites or other environmental releases of hazardous substances. This law was later amended by the Superfund Amendments and Reauthorization Act (SARA).

Concentration
The amount of a substance present in a certain amount of soil, water, air, food, blood, hair, urine, breath, or any other media.

Conditional major source permit
The purpose of the conditional major permit is to restrict the source's potential to emit regulated air pollutants below the major source threshold. Once approved, the source would not be required to obtain an operating permit under Title V of the Clean Air Act.

Confidence interval
Considers how much variation in a measure naturally occurs; for example, a 95% confidence interval for a rate indicates a range of values that would be expected to occur 95% of the time

Contaminant
A substance that is either present in an environment where it does not belong or is present at levels that might cause harmful (adverse) health effects.

Criteria air pollutants
A group of very common air pollutants regulated by EPA on the basis of criteria (information on health and/or environmental effects of pollution). Criteria air pollutants are widely distributed all over the country.

Crude Rate
A measure of the overall burden of a disease in a population that does not consider the impact of age and is derived by the formula:

$$\textit{Crude Rate} = \frac{\textit{Total Number of Events for all Years}}{\textit{Total Population for all Years}} \times 100{,}000$$

Dermal
Referring to the skin. For example, dermal absorption means passing through the skin.

Dermal contact
Contact with (touching) the skin [see route of exposure].

Descriptive epidemiology
The study of the amount and distribution of a disease in a specified population by person, place, and time.

Detection limit
The lowest concentration of a chemical that can reliably be distinguished from a zero concentration.

Dose (for chemicals that are not radioactive)
The amount of a substance to which a person is exposed over some time period. Dose is a measurement of exposure. Dose is often expressed as milligram (amount) per kilogram (a measure of body weight) per day (a measure of time) when people eat or drink contaminated water, food, or soil. In general, the greater the dose, the greater the likelihood of an effect. An

"exposure dose" is how much of a substance is encountered in the environment. An "absorbed dose" is the amount of a substance that actually got into the body through the eyes, skin, stomach, intestines, or lungs.

Dose-response relationship
The relationship between the amount of exposure [dose] to a substance and the resulting changes in body function or health (response).

Emission: Pollution discharged into the atmosphere from smokestacks, other vents, and surface areas of commercial or industrial facilities; from residential chimneys; and from motor vehicle, locomotive, or aircraft exhausts. Release of pollutants into the air from a source. We say sources emit pollutants.

Environmental media
Soil, water, air, biota (plants and animals), or any other parts of the environment that can contain contaminants.

Environmental media and transport mechanism
Environmental media include water, air, soil, and biota (plants and animals). Transport mechanisms move contaminants from the source to points where human exposure can occur. The environmental media and transport mechanism is the second part of an exposure pathway.

EPA
United States Environmental Protection Agency.

Epidemiology
The study of the distribution and determinants of disease or health status in a population; the study of the occurrence and causes of health effects in humans.

Excess cancer risk
A theoretical risk for getting cancer if exposed to a substance every day for 70 years (a lifetime exposure). The true risk might be lower. Excess cancer refers to the extra cancers that might occur with exposure, above the number that would normally occur without exposure. Example: the background rate of a particular cancer is 110 per 100,000 people or 1,100 per million people. Exposure to a particular chemical at the 1 in a million risk level, might add 1 more cancer to the 1,100 people who have gotten the cancer without the exposure.

Exposure
Contact with a substance by swallowing, breathing, or touching the skin or eyes. Exposure may be short-term [acute exposure], of intermediate duration, or long-term [chronic exposure].

Exposure assessment
The process of finding out how people come into contact with a hazardous substance, how often and for how long they are in contact with the substance, and how much of the substance they are in contact with.

Exposure pathway
The route a substance takes from its source (where it began) to its end point (where it ends), and how people can come into contact with (or get exposed to) it. An exposure pathway has five parts: a source of contamination (such as an abandoned business); an environmental media and transport mechanism (such as movement through groundwater); a point of exposure (such as a private well); a route of exposure (eating, drinking, breathing, or touching), and a receptor population (people potentially or actually exposed). When all five parts are present, the exposure pathway is termed a completed exposure pathway.

Fetoxic
Toxic to fetuses.

Fugitive emissions
Emissions are those emissions not caught by a capture system.

Geographic information system (GIS)
A mapping system that uses computers to collect, store, manipulate, analyze, and display data. For example, GIS can show the concentration of a contaminant within a community in relation to points of reference such as streets and homes.

Half-life ($t_{½}$)
The time it takes for half the original amount of a substance to disappear. In the environment, the half-life is the time it takes for half the original amount of a substance to disappear when it is changed to another chemical by bacteria, fungi, sunlight, or other chemical processes. In the human body, the half-life is the time it takes for half the original amount of the substance to disappear, either by being changed to another substance or by leaving the body. In the case of radioactive material, the half life is the amount of time necessary for one half the initial number of radioactive atoms to change or transform into another atom (that is normally not radioactive). After two half lives, 25% of the original number of radioactive atoms remain.

Hazard
A source of potential harm from past, current, or future exposures.

Hazardous air pollutants (HAPs)
Chemicals that cause serious health and environmental effects. Health effects include cancer, birth defects, nervous system problems and death due to massive accidental releases such as occurred at the pesticide plant in Bhopal, India. Hazardous air pollutants are released by *sources* such as chemical plants, dry cleaners, printing plants, and motor vehicles (cars, trucks, buses, etc.)

Hazardous Substance Release and Health Effects Database (HazDat)
The scientific and administrative database system developed by ATSDR to manage data collection, retrieval, and analysis of site-specific information on hazardous substances, community health concerns, and public health activities.

Hazardous waste
Potentially harmful substances that have been released or discarded into the environment.

Health consultation
A review of available information or collection of new data to respond to a specific health question or request for information about a potential environmental hazard. Health consultations are focused on a specific exposure issue. Health consultations are therefore more limited than a public health assessment, which reviews the exposure potential of each pathway and chemical [compare with public health assessment].

Health education
Programs designed with a community to help it know about health risks and how to reduce these risks.

Health investigation
The collection and evaluation of information about the health of community residents. This information is used to describe or count the occurrence of a disease, symptom, or clinical measure and to evaluate the possible association between the occurrence and exposure to hazardous substances.

Health promotion
The process of enabling people to increase control over, and to improve, their health.

Health statistics review
The analysis of existing health information (i.e., from death certificates, birth defects registries, and cancer registries) to determine if there is excess disease in a specific population, geographic area, and time period. A health statistics review is a descriptive epidemiologic study.

Incidence
The number of people who develop a disease within a year, does not include people previously diagnosed.

Indeterminate public health hazard
The category used in ATSDR's public health assessment documents when a professional judgment about the level of health hazard cannot be made because information critical to such a decision is lacking.

Incidence
The number of new cases of disease in a defined population over a specific time period [contrast with prevalence].

Ingestion
The act of swallowing something through eating, drinking, or mouthing objects. A hazardous substance can enter the body this way [see route of exposure].

Inhalation
The act of breathing. A hazardous substance can enter the body this way [see route of exposure].

Initiator
It is believed that chemical carcinogenesis is a two stage process that involves an initiator and a promotor. An initiator is a substance which possesses metabolites that directly binds to DNA to cause a mutation. Examples of chemical initiators are aflatoxin B1, vinyl chloride, nitrosamines, and aromatic amines.

Intermediate duration exposure
Contact with a substance that occurs for more than 14 days and less than a year [compare with acute exposure and chronic exposure].

Intratracheal instillation
The placement of a liquid onto the trachea of a test animal.

Lowest-observed-adverse-effect level (LOAEL)
The lowest tested dose of a substance that has been reported to cause harmful (adverse) health effects in people or animals.

Mean
A value that is computed by dividing the sum of a set of values by the number of values.

Mean rate
A measure of the overall burden of a disease in a population that represents the mathematical average of all of the rates considered; for example, in this public health assessment the mean rate for 1990-2003 would be the sum of the crude rates for each year divided by 14 years; derived by the formula:

$$Mean\ Rate\ = \left[\sum \left(\frac{Total\ Number\ of\ Events\ for\ a\ Specific\ Year}{Total\ Population\ for\ a\ Specifc\ Year} \times 100{,}000 \right) \right] \div Number\ of\ Years$$

Mechanism of Action
The mechanism by which chemicals produce their toxic effects, i.e., the mechanism by which a chemical alters normal cellular biochemistry and physiology. Mechanisms can include; interference with normal receptor-ligand interactions, interference with membrane functions, interference with cellular energy production, and binding to biomolecules.

Median
A value in an ordered set of values below and above which there is an equal number of values or which is the arithmetic mean of the two middle values if there is no one middle number.

Metabolism
The conversion or breakdown of a substance from one form to another by a living organism.

Metabolite
Any product of metabolism.

mg/kg
Milligram per kilogram.

mg/m^3
Milligram per cubic meter; a measure of the concentration of a chemical in a known volume (a cubic meter) of air, soil, or water.

Migration
Moving from one location to another.

Minimal risk level (MRL)
An ATSDR estimate of daily human exposure to a hazardous substance at or below which that substance is unlikely to pose a measurable risk of harmful (adverse), noncancerous effects. MRLs are calculated for a route of exposure (inhalation or oral) over a specified time period (acute, intermediate, or chronic). MRLs should not be used as predictors of harmful (adverse) health effects [see reference dose].

Monitoring: Periodic or continuous surveillance or testing to determine the level of compliance with statutory requirements and/or pollutant levels in various media or in humans, plants, and animals.

Morbidity
State of being ill or diseased. Morbidity is the occurrence of a disease or condition that alters health and quality of life.

Mortality
Death. Usually the cause (a specific disease, a condition, or an injury) is stated.

Mutagen
A substance that causes mutations (genetic damage).

Mutation
A change (damage) to the DNA, genes, or chromosomes of living organisms.

National Priorities List for Uncontrolled Hazardous Waste Sites (National Priorities List or **NPL)**
EPA's list of the most serious uncontrolled or abandoned hazardous waste sites in the United States. The NPL is updated on a regular basis.

National Toxicology Program (NTP)
Part of the Department of Health and Human Services. NTP develops and carries out tests to predict whether a chemical will cause harm to humans.

No apparent public health hazard
A category used in ATSDR's public health assessments for sites where human exposure to contaminated media might be occurring, might have occurred in the past, or might occur in the future, but where the exposure is not expected to cause any harmful health effects.

No-observed-adverse-effect level (NOAEL)
The highest tested dose of a substance that has been reported to have no harmful (adverse) health effects on people or animals.

No public health hazard
A category used in ATSDR's public health assessment documents for sites where people have never and will never come into contact with harmful amounts of site-related substances.

NPL [see National Priorities List for Uncontrolled Hazardous Waste Sites]

Ozone
A gas which is a variety of oxygen. The oxygen gas found in the air consists of two oxygen atoms stuck together; this is molecular oxygen. Ozone consists of three oxygen atoms stuck together into an ozone molecule. Ozone occurs in nature; it produces the sharp smell you notice near a lightning strike. High concentrations of ozone gas are found in a layer of the atmosphere -- the stratosphere -- high above the Earth. Stratospheric ozone shields the Earth against harmful rays from the sun, particularly ultraviolet B. Smog's main component is ozone; this ground-level ozone is a product of reactions among chemicals produced by burning coal, gasoline and other fuels, and chemicals found in products including solvents, paints, hairsprays, etc.

p-Value
More formally called the probability value; indicates the probability of something occurring for reasons other than just by chance; as a p-value becomes smaller, the event is less likely to occur just by chance; p-values smaller than 0.05 are usually considered statistically significant.

Particulate matter
A criteria air pollutant. Particulate matter includes dust, soot and other tiny bits of solid materials that are released into and move around in the air. Particulates are produced by many sources, including burning of diesel fuels by trucks and buses, incineration of garbage, mixing and application of fertilizers and pesticides, road construction, industrial processes such as steel making, mining operations, agricultural burning (field and slash burning), and operation of fireplaces and woodstoves. Particulate pollution can cause eye, nose and throat irritation and other health problems.

Physiologically based pharmacokinetic model (PBPK model)
A computer model that describes what happens to a chemical in the body. This model describes how the chemical gets into the body, where it goes in the body, how it is changed by the body, and how it leaves the body.

Pica
A craving to eat nonfood items, such as dirt, paint chips, and clay. Some children exhibit pica-related behavior.

Plume
A volume of a substance that moves from its source to places farther away from the source. Plumes can be described by the volume of air or water they occupy and the direction they move. For example, a plume can be a column of smoke from a chimney or a substance moving with groundwater.

Point of exposure
The place where someone can come into contact with a substance present in the environment [see exposure pathway].

Population
A group or number of people living within a specified area or sharing similar characteristics (such as occupation or age).

ppb
Parts per billion.

ppm
Parts per million.

Prevalence
The number of existing disease cases in a defined population during a specific time period [contrast with incidence].

Prevention
Actions that reduce exposure or other risks, keep people from getting sick, or keep disease from getting worse.

Promoter
A promotor is a chemical that needs to be given in multiple doses or over a prolonged period of time to cause tumors to grow by activating enzymes and other components involved in cell division. A promoter does not cause DNA damage directly; it enhances the likelihood that mutations resulting from DNA damage will not be fixed during cell replication, thus resulting in cancer.

Public availability session
An informal, drop-by meeting at which community members can meet one-on-one with ATSDR staff members to discuss health and site-related concerns.

Public comment period
An opportunity for the public to comment on agency findings or proposed activities contained in

draft reports or documents. The public comment period is a limited time period during which comments will be accepted.

Public health action
A list of steps to protect public health.

Public health advisory
A statement made by ATSDR to EPA or a state regulatory agency that a release of hazardous substances poses an immediate threat to human health. The advisory includes recommended measures to reduce exposure and reduce the threat to human health.

Public health assessment (PHA)
An ATSDR document that examines hazardous substances, health outcomes, and community concerns at a hazardous waste site to determine whether people could be harmed from coming into contact with those substances. The PHA also lists actions that need to be taken to protect public health [compare with health consultation].

Public health hazard
A category used in ATSDR's public health assessments for sites that pose a public health hazard because of long-term exposures (greater than 1 year) to sufficiently high levels of hazardous substances or radionuclides that could result in harmful health effects.

Public health hazard categories
Public health hazard categories are statements about whether people could be harmed by conditions present at the site in the past, present, or future. One or more hazard categories might be appropriate for each site. The five public health hazard categories are no public health hazard, no apparent public health hazard, indeterminate public health hazard, public health hazard, and urgent public health hazard.

Public health statement
The first chapter of an ATSDR toxicological profile. The public health statement is a summary written in words that are easy to understand. The public health statement explains how people might be exposed to a specific substance and describes the known health effects of that substance.

Public health surveillance
The ongoing, systematic collection, analysis, and interpretation of health data. This activity also involves timely dissemination of the data and use for public health programs.

Public meeting
A public forum with community members for communication about a site.

RCRA [see Resource Conservation and Recovery Act (1976, 1984)]

Reference dose (RfD)
An EPA estimate, with uncertainty or safety factors built in, of the daily lifetime dose of a substance that is unlikely to cause harm in humans.

Registry
A systematic collection of information on persons exposed to a specific substance or having specific diseases [see exposure registry and disease registry].

Remedial investigation
The CERCLA process of determining the type and extent of hazardous material contamination at a site.

Resource Conservation and Recovery Act (1976, 1984) (RCRA)
This Act regulates management and disposal of hazardous wastes currently generated, treated, stored, disposed of, or distributed.

RfD [see reference dose]

Risk
The probability that something will cause injury or harm.

Risk communication
The exchange of information to increase understanding of health risks.

Route of exposure
The way people come into contact with a hazardous substance. Three routes of exposure are breathing [inhalation], eating or drinking [ingestion], or contact with the skin [dermal contact].

Safety factor [see uncertainty factor]

Sample
A portion or piece of a whole. A selected subset of a population or subset of whatever is being studied. For example, in a study of people the sample is a number of people chosen from a larger population [see population]. An environmental sample (for example, a small amount of soil or water) might be collected to measure contamination in the environment at a specific location.

Sample size
The number of units chosen from a population or an environment.

Scorecard
A website developed by the Environmental Defense Fund that uses information from the Toxic Release Inventory to interactively compile reports on pollution by county.

Solvent
A liquid capable of dissolving or dispersing another substance (for example, acetone or mineral spirits).

Source of contamination
The place where a hazardous substance comes from, such as a landfill, waste pond, incinerator, storage tank, or drum. A source of contamination is the first part of an exposure pathway.

Special populations
People who might be more sensitive or susceptible to exposure to hazardous substances because of factors such as age, occupation, sex, or behaviors (for example, cigarette smoking). Children, pregnant women, and older people are often considered special populations.

Stakeholder
A person, group, or community who has an interest in activities at a hazardous waste site.

Statistical significance
When something occurs for reasons other than just by chance, usually at least 95% of the time; indicated by a p-value (i.e. probability value) of 0.05 or smaller

Statistics
A branch of mathematics that deals with collecting, reviewing, summarizing, and interpreting data or information. Statistics are used to determine whether differences between study groups are meaningful.

Substance
A chemical.

Superfund [see Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and Superfund Amendments and Reauthorization Act (SARA)

Superfund Amendments and Reauthorization Act (SARA)
In 1986, SARA amended the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and expanded the health-related responsibilities of ATSDR. CERCLA and SARA direct ATSDR to look into the health effects from substance exposures at hazardous waste sites and to perform activities including health education, health studies, surveillance, health consultations, and toxicological profiles.

Surface water
Water on the surface of the earth, such as in lakes, rivers, streams, ponds, and springs [compare with groundwater].

Surveillance [see public health surveillance]

Survey
A systematic collection of information or data. A survey can be conducted to collect information from a group of people or from the environment. Surveys of a group of people can be conducted by telephone, by mail, or in person. Some surveys are done by interviewing a group of people [see prevalence survey].

Synergistic effect
A biologic response to multiple substances where one substance worsens the effect of another substance. The combined effect of the substances acting together is greater than the sum of the effects of the substances acting by themselves [see additive effect and antagonistic effect].

t-Test
A statistical procedure that compares the difference between individual values and the mean of all the values studied

Teratogen
A substance that causes defects in development between conception and birth. A teratogen is a substance that causes a structural or functional birth defect.

Title V
Title V of the federal Clean Air Act requires major stationary sources of air pollution and a limited group of non-major sources to obtain operating permits that assure compliance with all applicable federal air pollution control requirements.

Toxic agent
Chemical or physical (for example, radiation, heat, cold, microwaves) agents that, under certain circumstances of exposure, can cause harmful effects to living organisms.

Toxicological profile
An ATSDR document that examines, summarizes, and interprets information about a hazardous substance to determine harmful levels of exposure and associated health effects. A toxicological profile also identifies significant gaps in knowledge on the substance and describes areas where further research is needed.

Toxicology
The study of the harmful effects of substances on humans or animals.

Toxic release inventory
Database of toxic releases in the United States compiled from SARA Title III Section 313 reports.

Tumor
An abnormal mass of tissue that results from excessive cell division that is uncontrolled and progressive. Tumors perform no useful body function. Tumors can be either benign (not cancer) or malignant (cancer).

Uncertainty factor
Mathematical adjustments for reasons of safety when toxicity knowledge is incomplete. Uncertainty factors are used to account for variations in people's sensitivity, for differences between animals and humans, and for differences between using a lowest effect level and a no

effect level. Scientists use uncertainty factors when they have some, but not all, the information from animal or human studies to decide whether an exposure will cause harm to people.

Urgent public health hazard
A category used in ATSDR's public health assessments for sites where short-term exposures (less than 1 year) to hazardous substances or conditions could result in harmful health effects that require rapid intervention.

Volatile organic compounds (VOCs)
Organic compounds that evaporate readily into the air. VOCs include substances such as benzene, toluene, methylene chloride, and methyl chloroform.

Certification

This Loudon County Hazardous Air Pollutants Public Health Assessment was prepared by the Tennessee Department of Health Environmental Epidemiology under a Cooperative Agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It was prepared in accordance with the approved methodology and procedures that existed at the time the health consultation was begun. The editorial review was completed by the cooperative agreement partner.

Technical Project Officer, CAT, SPAB, DHAC, ATSDR

The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health assessment and concurs with the findings.

Team Leader, CAT, SPAB, DHAC, ATSDR