Health Consultation

PUBLIC COMMENT RELEASE

PITTARD ROAD CANCER CLUSTER INVESTIGATION

ATHENS, CLARKE COUNTY, GEORGIA

MARCH 10, 2006

COMMENT PERIOD END DATE: APRIL 10, 2006

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Studies
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation 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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HEALTH CONSULTATION

PUBLIC COMMENT RELEASE

PITTARD ROAD CANCER CLUSTER INVESTIGATION

ATHENS, CLARKE COUNTY, GEORGIA

Prepared by:

Georgia Department of Human Resources
Division of Public Health
Under a cooperative agreement with the
Agency for Toxic Substances and Disease Registry

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ACRONYMS

NEHD – Northeast District Health Department

GDPH – Georgia Division of Public Health

GEPD – Georgia Environmental Protection Division

ATSDR – Agency for Toxic Substance and Disease Registry

EPA – U.S. Environmental Protection Agency

GCCR – Georgia Comprehensive Cancer Registry

ppb – parts per billion

*p*CI – picoCuries

CV – Comparison Value

VOC – Volatile Organic Compounds

TCE – Tricholorethylene or trichloroethene

Summary

A community member contacted the Georgia Department of Human Resources Northeast Health District (NEHD) regarding cancer cases in the Pittard Road community in Clarke County, Georgia. In response, NEHD and the Georgia Department of Human Resources, Division of Public Health (GDPH) conducted a cancer cluster investigation. In addition, this health consultation was prepared to summarize environmental sampling data, the cancer cluster investigation results, and community concerns to determine the extent of past, current, and future exposure to hazardous chemicals in the environment, and the potential for resulting health effects, including cancer.

This document contains information about the environmental transport and extent of human exposure to hazardous chemicals, conclusions about the health risks posed to residents, and recommendations intended to protect public health. A health consultation is designed to provide the community with information about the public health implications from exposure to hazardous substances at a specific site, and to identify populations for which further health actions are needed. It is not intended to serve the purpose of addressing liability, zoning, or other non-health issues.

The community member provided GDPH with a list of people who have been diagnosed with cancer. After NEHD and GDPH conducted analyses of the available cancer data for this community, it was determined that no elevated cancer rates or patterns are suspected. Although rates for Pittard Road residents may seem high, the cancers are not all one type; they are occurring in populations typically diagnosed with the specific cancer types, and the types of cancer are very common. NEHD and GDPH determined that Pittard Road is not a cancer cluster.

GDPH concludes that residents of the Pittard Road community are not at increased risk for adverse health effects from exposure to hazardous chemicals in groundwater or air, or radon in indoor air. GDPH has determined that there is **No Apparent Public Health Hazard** because: human exposure to contaminated media might be occurring, might have occurred in the past, or might occur in the future, but the exposures are at levels that are not expected to cause known health effects.

There are no recommendations at this time. GDPH will provide health education about cancer and individual water well maintenance to residents of the Pittard Road community. GDPH will review additional data if it becomes available and provide documents, if appropriate.

Purpose and Health Issues

In 2003, a member of the Georgia State House of Representatives contacted the Georgia Department of Human Resources, Division of Public Health, Northeast Health District (NEHD) about a suspected cancer cluster in the Pittard Road community, in Athens, Clarke County, Georgia. Initial information collected by NEHD revealed that several residents living along Pittard Road reported that they had been diagnosed with cancer, and some residents believed that the cancer cases may be the result of exposure to environmental contamination.

In response, the NEHD and the Georgia Division of Public Health (GDPH), Comprehensive Cancer Registry, conducted a cancer cluster investigation to determine whether cancer rates, particularly breast cancer, were elevated. More information about the Cancer Registry can be found at *http://health.state.ga.us/programs/gccr*.

In addition, the GDPH conducted this health consultation and a community needs assessment to investigate and respond to environmental health concerns. This health consultation: (1) summarizes the cancer cluster investigation results; (2) provides a description and history of the Pittard Road community; (3) evaluates environmental sampling data; (4) makes conclusions about the potential for exposure to hazardous chemicals and resulting health effects, and (5) addresses community health concerns.

Background

Site Description

The Pittard Road community is a neighborhood between by Highway 72 (Hull Road) and Old Elberton Highway/Spring Valley Road near the northeast border of Clarke County (Appendix A-1). It is a small residential community on approximately 16 acres bordered by woodland. Parallel to Hull Road near the intersection of Hull Road and Pittard Road is a set of railroad tracks dividing Pittard Road. To the south of the railroad tracks are single family homes with individual water wells, and to the north are multiple and single family homes connected to a municipal water source. The topography of Pittard Road is generally flat with a downward slope to the southeast.

Within one mile of the Pittard Road community are small commercial businesses, two mid-sized industrial facilities, a church and an elementary school. There is no history of any other industry in the area. There is no known hazardous waste generating site or landfill within a mile radius of this community. The railroad tracks may have been a source for chemical spills, but there is no evidence or report of such events.

Site History

Residents have expressed concern that they may have been exposed to environmental contamination that is resulting in an increased rate of cancer in the community. In April 2003, GDPH coordinated a well water sampling event and a literature review for potential sources of chemical contamination. NEHD and GDPH staff assisted the Georgia Environmental Protection Division (GEPD) as they collected samples from six wells in the Pittard Road community for chemical and bacteria analyses. Wells that were sampled were selected from a list of residents requesting that their wells be tested. Samples were analyzed for 130 chemicals listed under the U.S. Environmental Protection Agency's

Safe Drinking Water Act, and for coliform bacteria. Concurrently, the Clarke County Health Department sampled three additional wells for bacteria only. No chemical contaminants or bacteria were detected in groundwater above levels of health concern or exceeding environmental regulatory levels [1, 2].

During spring 2003, the Georgia Comprehensive Cancer Registry and NEHD conducted a cancer cluster investigation. No cancer cluster is suspected because the cancer cases did not meet the criteria as meeting the GDPH cancer cluster criteria [2]. For more information about these criteria, see the Cancer Cluster Investigation section below.

In July 2003, NEHD coordinated radon sampling for the homes on Pittard Road and provided residents with radon test kits. No radon levels were found at levels of health concern [1].

In 2004, GDPH began a health consultation investigation to determine if there are known or suspected releases of hazardous chemicals to environmental media (air, groundwater) in the Pittard Road area. GDPH staff reviewed environmental data and available information regarding past and present industrial/commercial land use, and reports of chemical emissions, leaks and spills. There are two mid-sized industrial facilities within one mile of the Pittard Road community. The facilities neither currently nor have in the past been under investigation by state or federal regulatory authorities, and they both remain in compliance with required permitting, rules, and regulations. A literature search indicates that one industry has a permit to release the solvent trichloroethene to outdoor air and, therefore, undergoes routine regulatory inspections. There is no evidence or report that spills or other environmental contamination from these industries have impacted groundwater used by residents or the ambient air in the Pittard Road community.

In Fall 2005, the GDPH also conducted an environmental health education needs assessment to assist NEHD with community health education, and evaluate public health activities. The needs assessment consisted of a community survey to gather specific information about environmental and public health concerns. Because residents with water wells were the only population that had expressed concerns, the needs assessment was limited to those residents living in the Pittard Road community to the south of the railroad tracks where residence use individual water wells [3].

Demographics

Demographic information for a 1-mile radius of the Pittard Road community shows the area is sparsely populated with 626 people. Using 2000 Census data, the Agency for Toxic Substances and Disease Registry (ATSDR) calculated population information for individuals residing within a 1-mile radius of the site using an area-proportion special analysis technique (Appendix A-1). For more information about ATSDR, see Appendix B.

Demographic information specifically for the Pittard Road community south of the railroad tracks has not been collected; however, community meetings and interviews reveal residents are almost exclusively Black/African-American.

Land Use

Land use in the area of Pittard Road is mixed with rural residential adjacent to an industrial zone. The Pittard Road community has single-family homes, and some families have lived on Pittard Road for

generations [3]. Pittard Road has always been a residential area, and no known industrial activity is documented [2, 3].

There are two creeks approximately one-half mile to the east and southwest of Pittard Road. There is no indication that these creeks are used for recreation or fishing.

Residents of the Pittard Road community use individual water wells and septic systems. There are nine drinking water wells in the Pittard Road community; several being shared by several residences.

Community Health Concerns

Several residents living along Pittard Road reported that they had been diagnosed with cancer, and some residents believed that the cancer cases may be the result of exposure to environmental contamination [3]. The NEHD and GDPH staff gathered community health concerns at several public meetings and through interviews and correspondence with area residents, activists, the elected state representative, and local media coverage [3]. During this health consultation investigation, the community also expressed concern about ambient (outside) air emissions from an industry located nearby.

To address Pittard Road residents' concerns, GDPH distributed the following information to each household:

- how to obtain cancer information and free breast cancer screening
- how to conduct water well maintenance and disinfection
- GDPH video "An Important Conversation: Georgia Speaks"
- down-well camera technology at no cost to residents of Pittard Road to assess well integrity, and to assist homeowners with well maintenance

Discussion

Environmental Sampling Data

This section presents results from environmental sampling. Data are presented and discussed along with relevant health-based comparison values. Comparison values (CVs) are screening levels, below which there is little likelihood of adverse health effects from exposure. When contaminant concentrations are below CVs, no further evaluation for human health is necessary and it can be concluded that adverse health impacts are not likely. When contaminant concentrations exceed CVs, it indicates that further evaluation of exposures and health impacts is needed [4, 5]. A detailed description of the CVs used in this health consultation are presented in Appendix D.

GDPH determines exposure to environmental contamination by examining exposure pathways. An exposure pathway is generally classified by environmental medium (e.g., water, soil, air, food). A completed exposure pathway exists when people are actually exposed through ingestion or inhalation of, or by skin contact with a contaminated medium. An exposure pathway consists of five elements: a source of contamination; transport through an environmental medium; a point of exposure; a route of exposure; and a receptor population.

In completed exposure pathways, all five elements are evident and indicate that exposure to a contaminant has occurred in the past, is presently occurring, or will occur in the future. GDPH

considers people as exposed if they come into contact with contamination and an exposure pathway is completed. For example, people who reside in an area with contaminants in air, or who drink water known to be contaminated, or who work or play in contaminated soil are considered to be exposed to contamination.

In potential pathways, at least one of the five elements is not clearly defined, but could exist. Potential pathways indicate that exposure to a contaminant could have occurred in the past, could be occurring or could occur in the future; however, important information regarding a potential pathway may not be available. An exposure pathway can be eliminated if at least one of the five elements is missing and will never be present.

Identification of an exposure pathway does not immediately imply health effects will occur. Exposures to contamination may or may not be at levels of concern. Thus, even if exposure has occurred, human health effects may not necessarily result [4, 5].

The potential exposure pathways for the Pittard Road Community are in Table 1. For this health consultation, groundwater, radon in indoor air, and ambient (outdoor) air are discussed. Environmental sampling data analyses results are presented in Tables 2 and 3.

Table 1. Potential Exposure Pathways

Pathway	Exposure Pathway Elements					Time
	Sources	Medium	Point of Exposure	Route of Exposure	Exposed Population	
Groundwater	Various	Groundwater	Drinking, Cooking, Bathing, Irrigation, Recreation	Ingestion, Inhalation, and Dermal absorption	Residents and Visitors	Past, Present, and Future
Indoor and Outdoor Air	Naturally occurring radon and industry emissions	Air	Respiration, Dermal Contact, Intentional Ingestion	Ingestion, Inhalation, and Dermal absorption	Residents and Visitors	Past, Present, and Future

Groundwater

Six of the nine individual water wells (Appendix A-3) were sampled and analyzed by GEPD for approximately 130 parameters under the Safe Drinking Water Act[1] including pesticides, metals, and coliform bacteria [1, 3]. NEHD sampled groundwater from all nine wells for radon (Appendix A-3) [3]. No samples had chemical or radon concentrations exceeding CVs or EPA Safe Drinking Water Standards[2] [1]. GDPH reviewed the available environmental sampling data, and did not identify any completed exposure pathways that warranted further evaluation. Table 2 summarizes the contaminants found in individual well water.

Table 2. Contaminants in Individual Well Water

Contaminant	Range of Sample Results	ATSDR Comparison Value	
	ppb (ug/L) *p*CI/L	ppb (ug/L) *p*CI/L	CV Type
Lead	0 – 3.8 ppb	15 ppb	MCL
Nitrate/Nitrite	1,600 – 4,800 ppb	10,000 ppb	MCL
Radon	263 – 1147 *pCI*/L	4,000 *p*CI/L	DWHA *

* ATSDR offered an alternative, more conservative comparison value from EPA's Drinking Water Health Advisory (DWHA) for a lifetime.

[1] The Safe Drinking Water Act (SDWA) authorizes the U.S. Environmental Protection Agency to set national health-based standards for drinking water to protect against both naturally-occurring and man-made contaminants that may be found in drinking water. (The SDWA does not regulate private wells which serve fewer than 25 individuals.) w*ww.epa.gov/safewater/sdwa*.

[2] U.S. Environmental Protection Agency: National Primary Drinking Water Standards. w*ww.epa.gov/OGWDW/consumer/pdf/mcl.pdf.*

Although chemical contaminants were not detected above levels of health concern, four of the six wells tested positive for bacteria, and residents were referred to the proper agencies to assist them with bacteria contamination [3].

Indoor Air

NEHD assisted 30 residents with testing for radon inside their homes [3]. Radon is a naturally occurring radioactive gas found in soil, air, and water that can cause lung cancer. Radon is odorless and tasteless. It is formed from the radioactive decay of naturally occurring uranium found in most rocks and soil. Radon is found at very low levels in all outdoor air, and can be found at unsafe levels in indoor air if cracks in the basement or foundation and poor ventilation allow radon gas to accumulate in the home [6]. See Appendix F for more information about radon.

Indoor air sample results showed that none of the homes tested had radon levels above CVs. Results are shown in Table 3.

Table 3. Radon in Indoor Air

Contaminant	Range of Sample Results	ATSDR Comparison Values	
	***p*CI/L**	***p*CI/L**	**CV Type**
Radon	0.3 – 1.8	4	EPA Action Limit

Outdoor Air

Ambient (outside) air in the Pittard Road community has not been sampled or monitored. GDPH assessed ambient air quality for the Pittard Road community by reviewing air modeling data for industries within one mile.

GEPD air emission permits are based on expected air emissions and EPA's risk-based exposure and toxicity values [7]. Expected air emissions and climate data are estimated using an EPA computer model called, "Industrial Source Complex Short Term" (ISCST) Model. This model uses stack parameters (height, exit velocity, etc.), actual weather data, and emissions to estimate concentrations of contaminants that may be emitted to air from a particular industrial process [7].

This model was used for emissions from a ball bearing maker, Nakanishi Manufacturing Corporation, which uses trichloroethene (TCE) as a degreaser at its factory at the intersection of Voyles Road and Spring Valley Road. The facility is about one mile from the Pittard Road community, and near Coile Middle School and New Grove Baptist Church. There are no other industries emitting regulated levels of contaminants to air within one mile of Pittard Road.

Nakanishi has an air permit from GEPD to release TCE. It is the largest emitter of TCE in Georgia emitting about half of all TCE in Georgia, and one of the largest emitters in the nation. Nakanishi emitted about 130,000 pounds of TCE in 2002 (350 pounds/day) [8]. From 1992 to 2002, total air

releases from Nakanishi increased 242% [8]. Based on modeled information calculated by GEPD from the Nakanishi facility perimeter for the current permit, TCE is expected to be emitted at 4.74 ug/m^3, which is equivalent to 0.88 parts per billion (ppb). See Appendix C for a detailed discussion about TCE calculations for emissions in air. ATSDR's lowest health based CV for TCE in ambient air is 100 ppb; therefore, the highest concentration modeled for facility perimeter ambient air is approximately 100 times less than the CV. Additional modeling projections for Pittard Road show TCE levels of 0.85 ug/m^3 [7]. Ultraviolet light, heat, and winds further reduce air concentrations of TCE in the Pittard Road community.

Wind Rose Data

GDPH also reviewed Natural Resource Conservation Service wind rose data for Athens. A wind rose is a graphical representation of prevalent wind speeds and wind direction for each month. Wind prevalence patterns revealed seasonal similarities.

Winds do not follow only one set path throughout various increments of time- their directions and speeds are always changing. Wind direction patterns, therefore, are not uniform but are analyzed for general trends. General trends give clues as to how the winds tend to behave at a certain location throughout the year. Wind rose trends are based on 30 years of wind pattern data collected hourly at various locations in Georgia [9]. For detailed information about wind roses, see Appendix D.

In the Athens area wind patterns tend to follow three general directional trends throughout the year. Overall, winds speeds range from 4 - 25 miles per hour (mph), with an average around eight mph. Winds predominantly blow from the northeastern and western (northwest, west, and southwest) directions; however, they may blow in any direction [9]. Winds blow at higher speeds from the northwest and northeast for 8 months out of the year (August through March), and calm winds blow from the western directions for the four months leading into summer (April through July) [9]. Nakanishi is located 1-mile from Pittard Road to the south, and Pittard Road is not in the path of the predominant winds directions.

Health Outcome Data

Cancer Cluster Investigation

The GDPH Comprehensive Cancer Registry (GCCR) is responsible for investigating Georgian's concerns about excess occurrence of cancer in their communities. A cancer cluster is defined as higher than expected rate of cancer cases in a specific area or a group of people or in a defined time period. A suspected cancer cluster is more likely to be a true cluster, rather than coincidence, if it involves:

- A large number of cases of a specific type of cancer rather than several different types;
- A rare type of cancer, rather than common types; and
- An increased number of cases of certain type of cancer in an age group that is not usually affected by that type of cancer.

The purpose of this type of investigation is to use scientific criteria to determine if there is a possible link between the cancer cases in an area and an environmental exposure.

Criteria

Cancer cluster investigation is a multi-stage process. The protocol for investigating possible cancer clusters is described in the Georgia draft *Cancer Cluster Investigation Manual* [2]. The cases under investigation must be confirmed before moving to the next level of inquiry. There are four levels of cancer cluster inquiry. If the criteria for one level of inquiry are met, the investigation proceeds to the next level.

The first step is to collect as much information about the cancer cases as possible from the person reporting the cancer cases. GCCR then compares the case information against its database for case verification and identifies if additional cases exist. Further stages of investigation include literature searches, statistical calculations, and feasibility studies. At each level of investigation, the inquiry should meet certain defined criteria to move to the next level of investigation as defined in the draft *Cancer Cluster Investigation Manual*. The Pittard Road inquiry was investigated using the same protocol [2].

Results

NEHD staff conducted door-to-door interviews with residents of the Pittard Road community and submitted patient listings to GCCR with seven cases of breast cancer and one case each of lymphoma and stomach cancer. Six out of nine cases (including one recurrence) were confirmed with the GCCR database. Not all reported cancer cases were verifiable. In addition, three persons not on the list provided by the NEHD were in the GCCR database. All cases were diagnosed between 1996 and 2002 (except for one breast cancer case diagnosed in 1987). Of the nine confirmed cases, five (56%) were breast cancer cases; the other four cases were lymphonma, lung, stomach (2 cases), and colon cancer [2]. Therefore, breast cancer was, by far, the most frequent cancer diagnosed in the study area.

The GCCR analyzed current (1995 – 2001) cancer incidence and mortality data available for Clarke County, and for zip code 30601. The area within a 1-mile radius of Pittard Road is almost completely contained within Clarke County boundaries and, therefore, Clarke County data were analyzed and compared to surrounding counties and the state of Georgia. Analyses of the cancer cases in the zip code and in Clarke County show that no cancer clusters and/or no statistically significant numbers of cancer cases have been reported [2] (Appendix E).

Data for zip code 30601 show that cancer incidence rates for all sites on the body are less than the expected rates for Clarke County and the state of Georgia. Incidence rates for breast cancer followed this same pattern. All data are age adjusted per 100,000 people. This means that the number of new cases occurring per given population over this time frame is as expected for Clarke County, and is less than expected for the zip code (Figure 1).

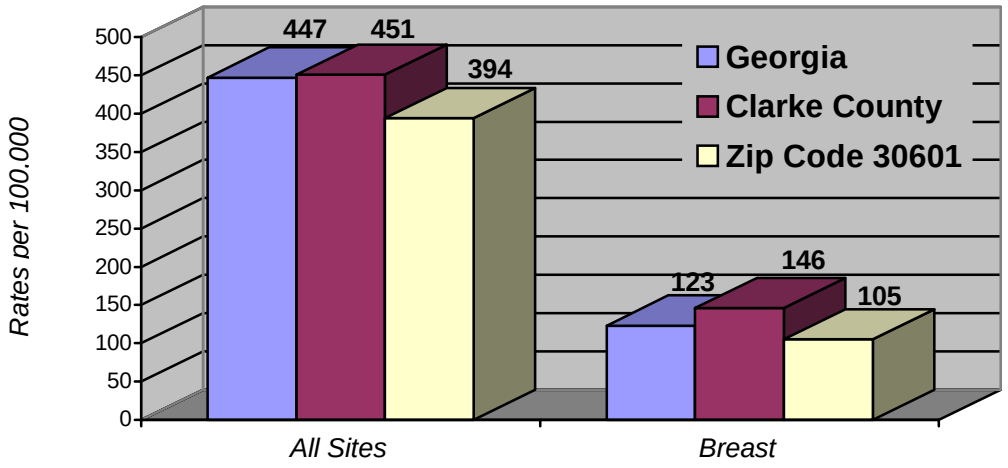
Several factors help to explain the perception that an elevated number of cancer cases exists among residents of the Pittard Road community. Among these factors are population size, familial ties, and variety of common cancers.

The population of the community is small and isolated from other residential areas. There are about 50 to 100 residents of Pittard Road at any given time; therefore, when several people are diagnosed with cancer, it may be considered a large percentage of the population.

Strong correlations suggest that breast cancer cases in the community are occurring in a few families. NEHD reports 40% (three) of Pittard Road community residents with breast cancer were found among members of one family. Early onset breast cancer was diagnosed in three daughters of two sisters. One sister had lived in the Pittard Road community for only one year, and her daughter had never resided in the Pittard Road community [3]. Having a first degree relative (mother - daughter) with cancer increases risk by two, and having two first-degree relatives increases risk of cancer by a factor of five [3, 10]. In addition, studies have not been able to identify any chemical in the environment or in our diets that is likely to cause breast cancer (American Cancer Society, *www.cancer.org*).

The following chart shows the age adjusted cancer incidence rates for Georgia, Clarke County, Zip Code for the Pittard Road community. A cancer incidence rate is the number of newly diagnosed cancers of a specific site/type occurring in a specified population during a year (or group of years), usually sepcified as the number of cancers per 100,000 population at risk. This document presents cancer data and breast cancer data as they are specific community concerns.

Figure 1. Age Adjusted Cancer Incidence Rates



State and county rates for 1999-2000, zip code rates 1995-2001

Source: Georgia Department of Human Resources, Division of Public Health, Comprehensive Cancer Registry, August 31, 2005

After careful consideration of the information collected, it was determined by GCCR that no cancer cluster exists in the area. Although there are an elevated number of breast cancer cases in the area, these cases occur among relatives. The number of cases of each type of cancer does not meet the criteria for determining that elevated rates or a cancer cluster exists. No further cancer cluster investigation activities are planned. If additional data become available, the information will be reviewed by GDPH and take appropriate actions.

There is no other health outcome data related to Pittard Road. According to the Clarke County Health Department, no health studies pertaining to this area have been performed in the community

Child Health Considerations

GDPH recognizes the unique vulnerabilities of young children exposed to chemicals in the environment. Because of their size, body weight, frequent hand to mouth activity, and developing systems, children require special emphasis in communities faced with environmental contamination. They may be more likely to come into contact with contaminants in the environment because they play outdoors, and they often bring food and toys into contaminated areas. Also, they receive higher doses of exposure because children's growing bodies absorb more contamination and can sustain permanent damage if exposures occur during critical growth stages.

This area does not pose a health threat to children because there is no evidence that children are being exposed to contaminants from the environment at levels that could cause adverse health effects. On the basis of current land use and available data, children are not being exposed to regulated contaminants at levels of health concern in groundwater or air, or radon in indoor air. As a general precaution, residents with young children should exercise caution that children do not trespass onto industrial properties to avoid physical danger.

Conclusions

GDPH concludes that residents of the Pittard Road community are not at increased risk for adverse health effects from exposure to the hazardous chemicals listed under the Safe Drinking Water Act, TCE in outdoor air, or radon in indoor air. GDPH has determined that there is **No Apparent Public Health Hazard** because: human exposures to contaminated media might be occurring, might have occurred in the past, or might occur in the future, but the exposures are at levels that are not expected to cause known adverse health effects.

GCCR has determined that cancer rates on Pittard Road are not higher than the county or state rates, and the number of cancer cases does not meet the necessary criteria for an unusual cluster of cancers. Excess cancer cases among residents of Pittard Road have a genetic component and are not associated with exposure to chemicals in the environment.

Recommendations

There are no recommendations at this time.

Public Health Action Plan

GDPH will provide health education about cancer and individual water well maintenance to residents of the Pittard Road community.

Actions Completed

- GDPH conducted a literature review of past and current commercial/industrial land use.
- NEHD and GDPH assisted GEPD with sampling six of the nine individual water wells for chemical and bacterial contaminants.
- The Clarke County Health Department concurrently sampled the remaining three wells for bacteria.
- NEHD conducted radon testing for all individual wells in the community.

- NEHD provided radon test kits for residents to test their homes.
- NEHD and GDPH conducted a cancer cluster investigation.
- GDPH provided each household with health education materials on how to obtain cancer information and free breast cancer screening
- GDPH provided each household with health education materials on how to conduct water well maintenance and disinfection
- GDPH provided each household with the video "An Important Conversation: Georgia Speaks"
- GDPH and the University of Georgia Cooperative Extension Service offered down-well camera technology at no cost to residents of Pittard Road to assess well integrity, and to assist homeowners with well maintenance

Actions Planned

GDPH will conduct health education program evaluation, and provide additional health education and services based on the results. GDPH will continue to respond to health concerns of residents in the area. GDPH will review additional data if it becomes available and provide documents, if appropriate.

References

1. Georgia Environmental Protection Division, *Memorandum: Water Sample Results from Pittard Road*, May 2003.
2. Georgia Division of Public Health, Comprehensive Cancer Registry, *Final Report for Pittard Road, Clarke County Inquiry, Draft*, 5/23/2003.
3. Northeast Health District, *Investigation into Occurrence of Cancer in the Pittard Road Community*, August 2004.
4. Agency for Toxic Substance and Disease Registry, *Comparison Values for Water*, January 10, 2005.
5. Agency for Toxic Substance and Disease Registry, *Comparison Values for Air*, January 10, 2005.
6. Agency for Toxic Substance and Disease Registry, *Fact Sheet: Radon*, www.atsdr.cdc.gov/tfacts145.html
7. Personal communication, Georgia Division of Public Health with Eric Cornwell, Georgia Air Protection Branch, Georgia Environmental Protection Division, September 1, 2005.
8. Personal communication, Georgia Division of Public Health with Heather Abrams, Stationary Source Permitting Program, Georgia Environmental Protection Division, August 11, 2005.
9. Natural Resource Conservation Service, *Wind Rose Data*, www.wcc.nrcs.usda.gov/climate/windrose.html.
10. Amal K. Mitra, M.D., M.P.H., Dr.P.H. et al, *Breast Cancer and Environmental Risks: Where is the Link*, Journal of Environmental Health, 66:7, 24-29, March 2004.

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CERTIFICATION

The Georgia Division of Public Health prepared this Pittard Road Cancer Cluster Investigation, Athens, Clarke County, Georgia, health consultation under a cooperative agreement with the Agency for Toxic Substances and Disease Registry. It is in accordance with approved methodology and procedures existing at the time the health consultation was begun. Editorial review was completed by the Cooperative Agreement partner.

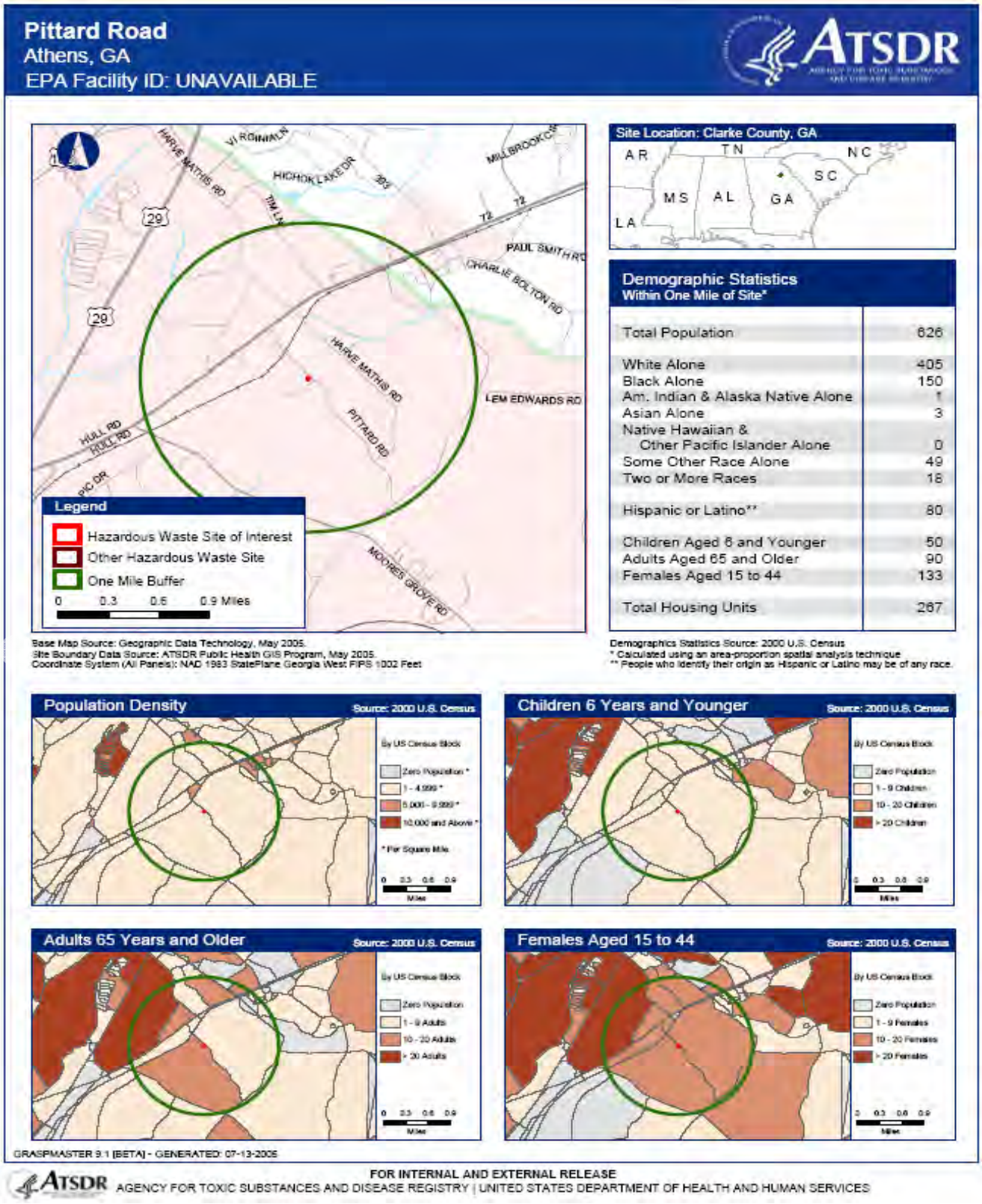
Technical Project Officer, SPAB, DHAC

The Division of Health Assessment and Consultation, ATSDR, has reviewed this health consultation and concurs with the findings.

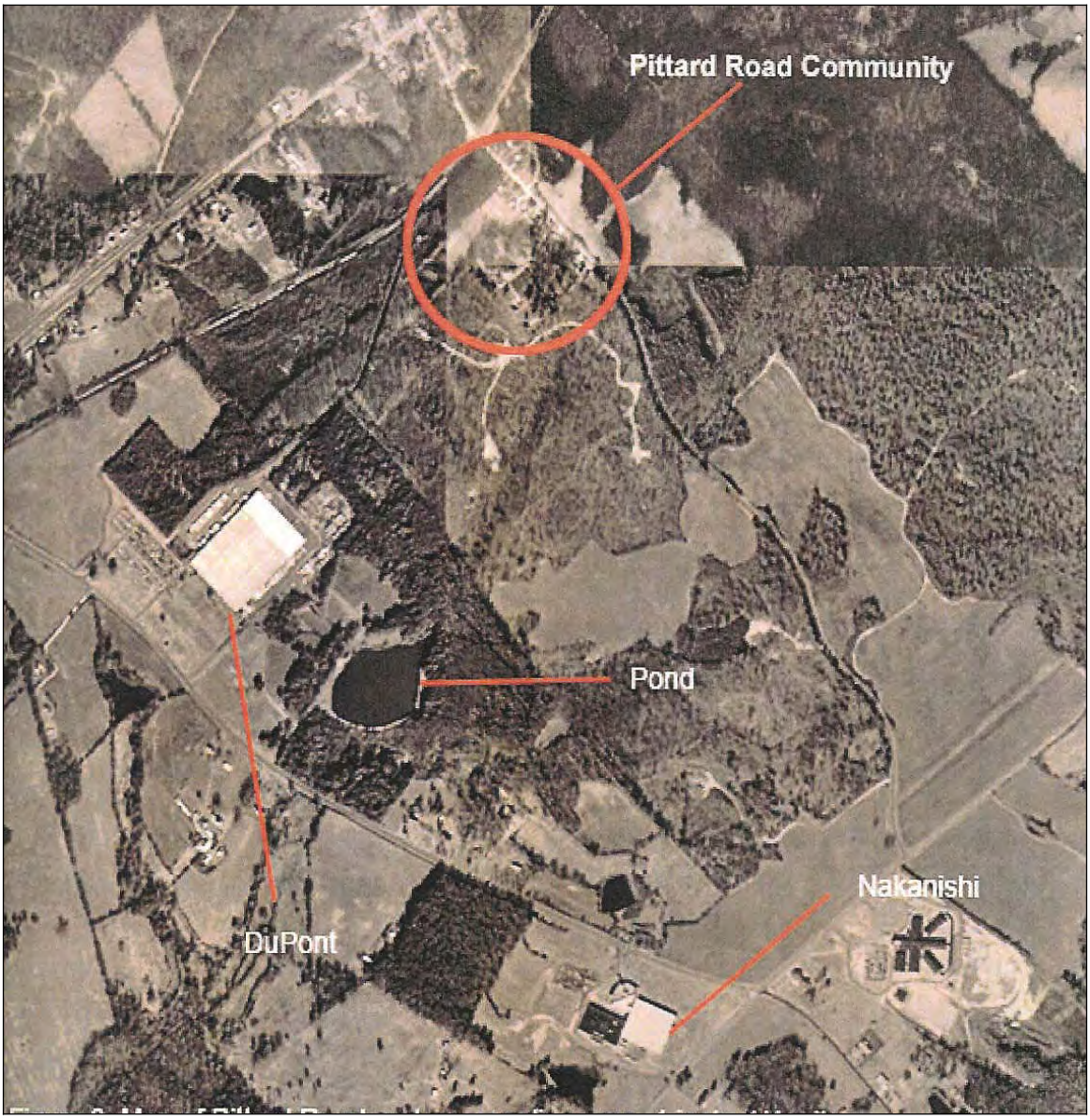
Alan D. Parker for Alan Yarbrough
Team Lead, CAT, SPAB, DHAC, ATSDR

APPENDICES

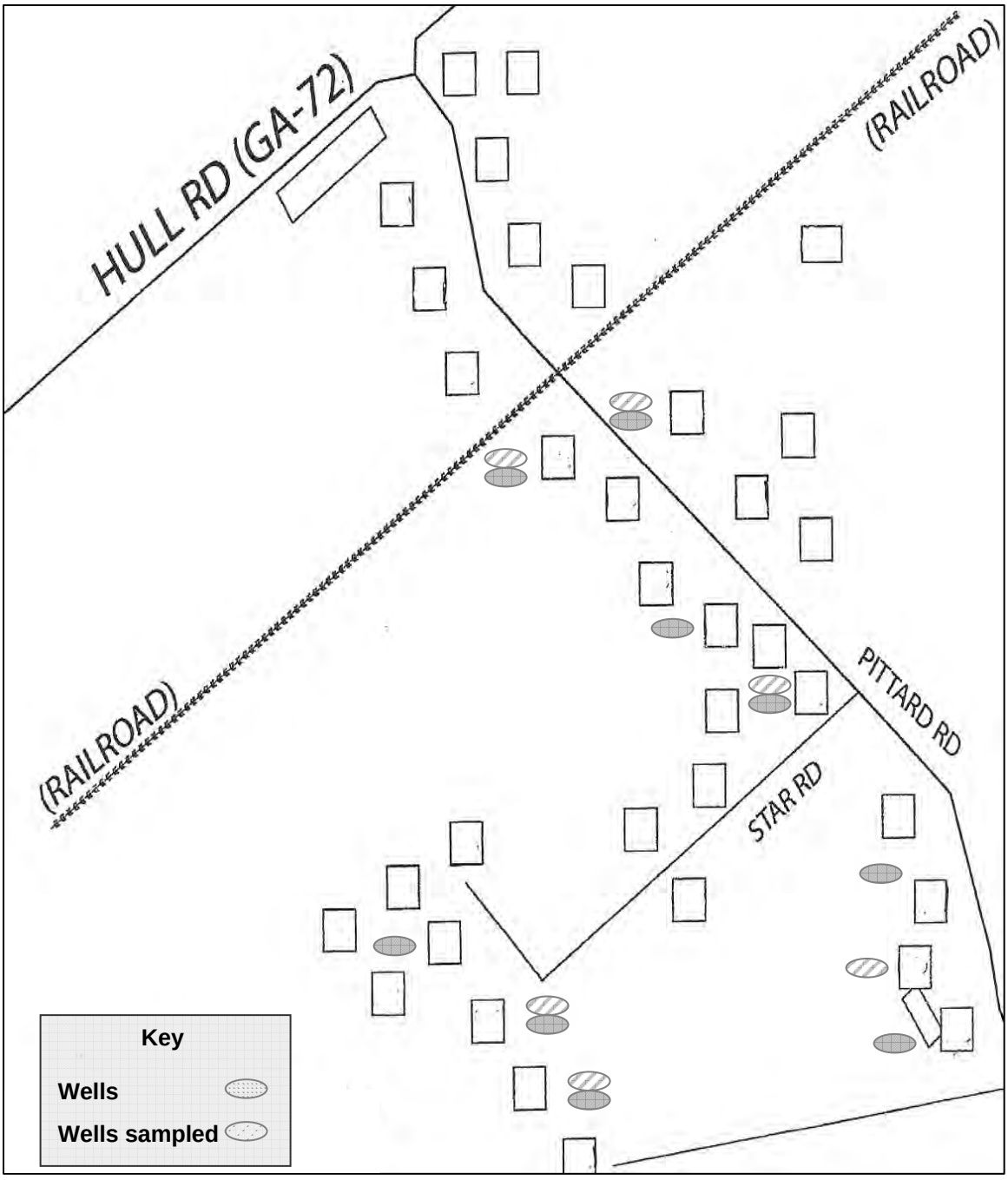
APPENDIX A-1: DEMOGRAPHIC MAP



APPENDIX A-2: AERIAL VIEW OF COMMUNITY [3]



APPENDIX A-3: WATER WELL SAMPLE LOCATIONS [3]



APPENDIX B: AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

What is the Agency for Toxic Substances and Disease Registry (ATSDR)?

ATSDR is the principal federal public health agency involved with hazardous waste issues. The agency helps prevent or reduce the harmful effects of exposure to hazardous substances on human health. The Superfund Law created ATSDR, an agency of the U.S. Department of Health and Human Services, in 1980.

Where is ATSDR located? How big is it?

ATSDR's headquarters are in Atlanta, Georgia. The agency has 10 regional offices and an office in Washington D.C. The multi- disciplinary staff of approximately 400 includes epidemiologists, physicians, toxicologists, engineers, public health educators, health communication specialists, and support staff.

What does ATSDR do?

ATSDR conducts a number of activities to help prevent or reduce the harmful effects of exposure to hazardous substances, including:

- Advises federal and state agencies, community members, and other interested parties on the health impacts of Superfund sites and other petitioned sites.
- Identifies communities where people might be exposed to hazardous substances in the environment.
- Determines the level of public health hazard posed by a site.
- Recommends actions that need to be taken to safeguard people's health.
- Conducts health studies in some communities that are located near Superfund sites or in locations where people have been exposed to toxic materials.
- Funds research conducted by colleges, state agencies, and others who study the relationship between hazardous waste exposure and illnesses.
- Educates physicians, other health care professionals, and community members about the health effects of--and how to lessen exposure to--hazardous substances.
- Provides technical support and advice to other federal agencies and state and local governments.
- Maintains registries of people who are exposed to the most dangerous substances.

What can ATSDR do to help a community that may be exposed to hazardous substances?

ATSDR helps communities in a variety of ways, including:

- Helps communities by working with them to resolve their health concerns.
- Determines whether the community is or was exposed to hazardous substances.
- Visits the community to hear residents voice their health concerns.
- Educates residents about any health hazards posed by environmental contaminants.
- Works with local health care providers to ensure they have the information needed to evaluate possible exposures to hazardous substances in their community.
- Visits a community to draw blood or to collect urine to determine if people have been or are being exposed to a hazardous substance when such actions are required.
- Provides medical monitoring in communities exposed to hazardous substances if such action is needed.

What can't ATSDR do to help a community?

- ATSDR does not have the legal authority to conduct certain activities, such as the following:
- Cannot provide medical care or treatment to people who have been exposed to hazardous substances, even if the exposure has made them ill.
- Cannot provide funds to relocate affected residents or to clean up a site.
- Cannot close down a plant or other business, but can make recommendations to the U.S. Environmental Protection Agency (EPA).

How is ATSDR's role in helping communities different from EPA's role?

Unlike EPA, ATSDR is not a regulatory agency. ATSDR is a public health agency that advises EPA on the health aspects of hazardous waste sites or spills. ATSDR makes recommendations to EPA when specific actions are needed to protect the public's health. For example, ATSDR might recommend providing an alternative water supply, removing contaminated material, or restricting access to a site. EPA usually follows these recommendations. However, ATSDR cannot require EPA to follow its recommendations.

How does ATSDR become involved with a site? How can I get ATSDR involved with a site?

ATSDR is required by the Superfund law to become involved with all sites that are on or proposed for the National Priorities List (NPL). Specifically, ATSDR conducts public health assessments of NPL sites, as well as of all sites proposed for the NPL. EPA, states, local governments, or other federal agencies may request ATSDR's help with a site, such as in cases of accidental spills or releases. Anyone may request or "petition" that ATSDR to do a health consultation. Most requests for health consultations come from EPA and state and local agencies. Anyone may also petition ATSDR to conduct a public health assessment of a site. For more information about how to petition ATSDR to conduct a public health assessment, call ATSDR's toll-free information line, 1-888-42-ATSDR (1-888-422-8737), or send an e-mail request to ATSDRIC@cdc.gov

How does ATSDR work with states and local health departments?

ATSDR has cooperative agreements (partnerships) with 23 states to conduct site-related public health assessments or health consultations, health studies, and health education. In states that have co- operative agreements, ATSDR provides technical assistance and oversees site evaluations and related activities done by state staff. ATSDR also assists local health departments.

Does ATSDR assist communities located near hazardous waste sites that are not on the NPL?

Yes. More than half of the sites ATSDR has worked at are not on the NPL.

What information does ATSDR provide through its Internet web site?

Information that can be accessed through ATSDR's web site includes these items: information about ATSDR; a database containing information on all sites where ATSDR has worked; short, easy-to-read fact sheets on 60 of the most common contaminants at Superfund sites; and links to related sites.

APPENDIX C: EXPLANATION OF TOXICOLOGICAL EVALUATION

Evaluation

For each environmental medium (for example; air, soil, groundwater), GDPH examines the types and concentrations of contaminants of concern (COCs). In preparing this document, GDPH used the ATSDR comparison values (CVs) to screen contaminants that may merit further evaluation. Comparison values are concentrations of contaminants that can reasonably (and conservatively) be regarded as harmless, assuming default conditions of exposure. The CVs generally include built in safety factors to ensure protection of sensitive populations. Because CVs do not represent a minimum level of toxicity, exposure to contaminant concentrations above CVs will not necessarily lead to adverse health effects. GDPH then considers how people may come into contact with the contaminants, such as inhalation, dermal, or ingestion. Because the level of exposure depends on the route and frequency of exposure and the concentration of the contaminants, this exposure information is essential to determine if a public health hazard exists.

When a contaminant exceeds a CV, further toxicological evaluation is required to identify which chemicals and exposure situations are likely to be a health concern. Separate child and adult exposure doses (or the amount of a contaminant that gets into a person's body) are calculated for site-specific scenarios, using assumptions regarding an individual's likelihood of accessing the site and contacting contamination. Exposure to contaminants may be ingested, inhaled, or absorbed through the skin. Exposure to a cancer-causing chemical, even at low concentrations, is assumed to be associated with some increased risk for evaluation purposes.

Step 1--The Screening Process

In order to evaluate the available data, GDPH used comparison values (CVs) to determine which chemicals to examine more closely. CVs are contaminant concentrations found in a specific environmental media (for example: air, soil, or water) and are used to select contaminants for further evaluation. CVs incorporate assumptions of daily exposure to the chemical and a standard amount of air, soil, or water that someone may inhale or ingest each day. CVs are generated to be conservative and non-site specific. The CV is used as a screening level during the health consultation process where substances found in amounts greater than their CVs might be selected for further evaluation. CVs are not intended to be environmental clean-up levels or to indicate that health effects occur at concentrations that exceed these values.

CVs can be based on either carcinogenic (cancer-causing) or non-carcinogenic effects. Cancer-based CVs are calculated from the U.S. Environmental Protection Agency's (EPA) oral cancer slope factors for ingestion exposure, or inhalation risk units for inhalation exposure. Non-cancer CVs are calculated from ATSDR's minimal risk levels, EPA's reference doses, or EPA's reference concentrations for ingestion and inhalation exposure. When a cancer and non-cancer CV exist for the same chemical, the lower of these values is used as a conservative measure. The chemical and media-specific CVs used in the preparation of this health consultation are listed below:

Maximum Contaminant Level (MCL): The maximum permissible level of a contaminant in water delivered to any user of a public system. MCLs are enforceable standards.

Step 2--Evaluation of Public Health Implications

The next step in the evaluation process is to take those contaminants that are above their respective CVs and further identify which chemicals and exposure situations are likely to be a health hazard. Separate child and adult exposure doses (or the amount of a contaminant that gets into a person's body) are calculated for site-specific scenarios, using assumptions regarding an individual's likelihood of accessing the site and contacting contamination. A brief explanation of the calculation of estimated exposure doses used in this health consultation is presented below. Calculated doses are reported in units of milligrams per kilogram per day (mg/kg/day).

Concentration Calculations for Emissions in Air

Concentration in air is measured in parts per billion (ppb). However, air sampling results are expressed in mass per unit volume. Therefore, a conversion from mass per unit volume to concentration in ppb is necessary. The formula used to determine air concentrations is as follows:

Conversion Factor for Air

$$C_{\mu g\ /\ m^3} = C_{ppb} \times \frac{MW(g\ /\ mole)}{24.45}$$

Therefore: concentration in air_{ppb} = $\frac{\text{Conversion Constant}}{\text{Molecular Weight } AMU_{chem.}}$ x concentration of emissions

Concentration of TCE in air

C_{air} = (24.45 /131.4 AMU) (modeled concentration at business property line)

C_{air} = (24.45 AMU /131.4 AMU)(4.74 µg/m^3) = 4.74/5.37 = **0.88 ppb** (at business property line)

Health Based CV (EMEG) = **100 ppb**

Environmental Media Evaluation Guides (EMEGs) are specific comparison values developed by ATSDR for use in selecting environmental contaminants for non-cancer health concerns. EMEGs are derived from Minimal Risk Levels (see below). Exposure to a level of contaminant below this level should not result in any noncancer, adverse health effects.

Non-cancer Health Risks

If a contaminant level exceeds a CV, the doses calculated for exposure to individual chemicals are then compared to an established health guideline, such as an ATSDR minimal risk level (MRL) or an EPA reference dose (RfD), in order to assess whether adverse health impacts from exposure are expected. Health guidelines are chemical-specific values that are based on available scientific literature and are considered protective of human health. Non-carcinogenic effects, unlike carcinogenic effects, are believed to have a threshold, that is, a dose below which adverse health effects will not occur. As a result, the current practice to derive health guidelines is to identify, usually from animal toxicology experiments, a no observed adverse effect level (NOAEL), which indicates that no effects are observed at a particular exposure level. This is the experimental exposure level in animals (and sometimes humans) at which no adverse toxic effect is observed. The known toxicological values are doses derived from human and animal studies that are summarized in ATSDR's *Toxicological Profiles*

(www.atsdr.cdc.gov/toxpro2.html). The NOAEL is modified with an uncertainty (or safety) factor, which reflects the degree of uncertainty that exists when experimental animal data are extrapolated to the human population. The magnitude of the uncertainty factor considers various factors such as sensitive subpopulations (e.g., children, pregnant women, the elderly), extrapolation from animals to humans, and the completeness of the available data. Thus, exposure doses at or below the established health guideline are not expected to cause adverse health effects because these values are much lower (and more human health protective) than doses, which do not cause adverse health effects in laboratory animal studies.

Minimal Risk Levels (MRLs) are estimates of daily humans exposure to a chemical that is likely to be without an appreciable risk of harmful effects (noncarcinogenic) over a specified duration of exposure. MRLs are based on human and animal studies and are reported for Acute (14 days or less), intermediate (15-354 days), and chronic (365 days or more).

If the estimated exposure dose to an individual is less than the health guideline value, the exposure is unlikely to result in non-cancer health effects. If the calculated exposure dose is greater than the health guideline, the exposure dose is compared to known toxicological values for the particular chemical and is discussed in more detail in the text of the health consultation. A direct comparison of site-specific exposures and doses to study-derived exposures and doses found to cause adverse health effects is the basis for deciding whether health effects are likely to occur.

It is important to consider that the methodology used to develop health guidelines does not provide any information on the presence, absence, or level of cancer risk. Therefore, a separate cancer risk evaluation is necessary for potentially cancer-causing contaminants detected at this site.

Cancer Risks

Exposure to a cancer-causing chemical, even at low concentrations, is assumed to be associated with some increased risk for evaluation purposes. The estimated risk for developing cancer from exposure to contaminants associated with the site was calculated by multiplying the site-specific doses by EPA's chemical-specific cancer slope factors (CSFs) available at *www.epa.gov/iris*. This calculation estimates a theoretical excess cancer risk expressed as a proportion of the population that may be affected by a carcinogen during a lifetime of exposure. For example, an estimated risk of 1×10^{-6} predicts the probability of one additional cancer over background in a population of 1 million. An increased lifetime cancer risk is not a specified estimate of expected cancers. Rather, it is an estimate of the increase in the probability that a person may develop cancer sometime in his or her lifetime following exposure to a particular contaminant under specific exposure scenarios. For children, the theoretical excess cancer risk is not calculated for a lifetime of exposure, but from a fraction of lifetime; based on known or suspected length of exposure, or years of childhood.

Because of conservative models used to derive CSFs, using this approach provides a theoretical estimate of risk; the true or actual risk is unknown and could be as low as zero. Numerical risk estimates are generated using mathematical models applied to epidemiological or experimental data for carcinogenic effects. The mathematical models extrapolate from higher experimental doses to lower experimental doses. Often, the experimental data represent exposures to chemicals at concentrations orders of magnitude higher than concentrations found in the environment. In addition, these models

often assume that there are no thresholds to carcinogenic effects--a single molecule of a carcinogen is assumed to be able to cause cancer.

The doses associated with these estimated hypothetical risks might be orders of magnitude lower than doses reported in toxicology literature to cause carcinogenic effects. As such, a low cancer risk estimate of 1×10^{-6} and below may indicate that the toxicology literature supports a finding that no excess cancer risk is likely. A cancer risk estimate greater than 1×10^{-6}, however, indicates that a careful review of toxicology literature before making conclusions about cancer risks is in order.

It should be noted that chemicals known to cause cancer do not necessarily cause cancer in all individuals. Regardless of individual variance, to best protect public health dose calculations assume a worst case scenario (maximum exposure) to estimated associated risks. Additional orders of magnitude are built into the risk calculations to provide additional protection to public health. Therefore, an estimate of one additional cancer case in 1,000,000 is an estimate above average occurance.

APPENDIX D: WIND ROSE DATA

A wind rose gives a very brief but thorough view of how wind speed and direction are typically distributed at a particular location. A wind rose is presented in a circular format, and shows the frequency of winds blowing *from* particular directions. The length of each "spoke" around the circle is related to the frequency with which the wind blows from a particular direction. Each concentric circle represents a different frequency, emanating from zero at the center to increasing frequencies at the outer circles. The wind rose data available for Athens, Georgia, as in the example shown here, contains additional information, in that each spoke is broken down into discrete frequency categories that show the percentage of time that winds blow from a particular direction and at certain speed ranges. All wind roses shown here use 16 cardinal directions, such as north (N), NNE, NE, etc.

This rose shows that June winds in Athens blow from the west much of the time. In fact, the 5 westerly spokes (NW, WNW, W, WSW, and SW) comprise 39% of all hourly wind directions. This is calculated by taking the sum of the frequencies of each of these directions (7+8+8+9+7=39%). Winds from the NE blow 14% of the time, and winds from the south blow 11% of the time. Winds in this example blow from every direction, however, the predominant winds are westerly. This wind rose also shows that the wind rarely blows from the southeast or the north.

Wind roses also provide details on wind speeds from different directions. For example, examining winds from the southwest (the longest spoke) one can determine that approximately 5% of the wind blows from the southwest at speeds between 0.51 and 3.34 meters per second (m/sec). Similarly, winds blow from the southwest at speeds between 3.34 and 5.4 m/sec about 3% of the time (8% minus 5%), and at speeds between 5.4 and 8.49 m/sec about 1% of the time (9% minus 8%). Please note the legend at the bottom of the wind rose that gives the speed categories and their associated colors.

This example was chosen because it is a fair representation of wind rose data for each month throughout the year in Athens. It has to be noted winds from the south are strongest and most frequent in June, and are less frequent over the rest of the year. Therefore, the example presented reflects a worst case scenario. Overall, these three predominant directional trends follow seasonal patterns. Winter and early spring months showed a split trend of predominant winds blowing from the NW and NE. Wind speeds are higher during these months, averaging approximately 8.5 m/sec. Late spring and summer months show a trend of calmer winds blowing primarily from the western directions with a slightly higher frequency of winds blowing from the SW and NE. Summer wind speeds average about 3 m/sec. Winds are calmest in August, but they blow predominantly from the NE. Autumn winds blow predominantly from the NE and pick up speed, averaging approximately 7.5 m/sec.

The legend gives additional information such as the wind speed unit (m/sec), the average wind speed for the month over all hours, percentage of time that the winds are calm, and the data collection period including year data collection began, month of the year, and the hours data was collected. Each wind rose only shows the year in which data collection began. Although the year 1961 is presented, data covers 30 years (1961-1990). 24 readings per day are used to construct these wind roses.

To calculate the amount of time that the wind blows from a particular direction at a particular speed, the respective frequency is multiplied by the appropriate amount of time. In our example with Athens in June, there are 30 days x 24 hours/day in June, or 720 hours. From the wind rose we calculated that winds blow from the southwest at speeds between 0.51 and 5.4 m/sec 8% of the time. This represents

0.09 x 720 =64.8, or about 65 hours typically have winds from the southwest at these speeds at Athens in June.

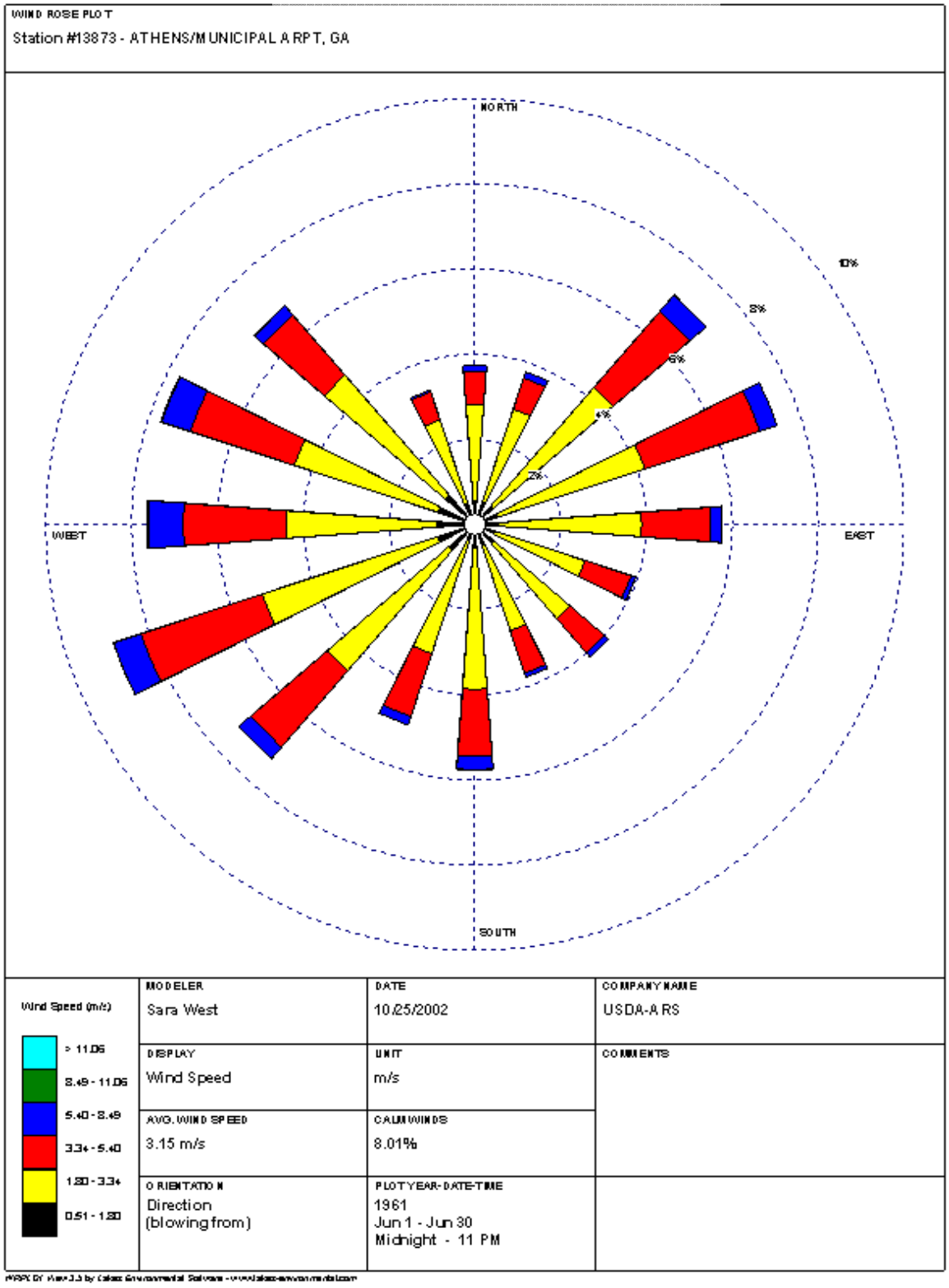
Wind Rose Data Collection

These wind roses are based on hourly data from the Solar and Meteorological Surface Observation Network (SAMSON) available from the National Climatic Data Center (*www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwAW~MP~CD*) for the 1961-1990 period of record. SAMSON is a 3-volume CD-ROM set is divided geographically into Eastern, Central, and Western U.S. regions. It contains hourly solar radiation data along with selected meteorological elements for the period 1961-1990. It encompasses 237 NWS stations in the United States, plus offices in Guam and Puerto Rico. The dataset includes both observational and modeled data.

The hourly winds measured at airports are normally averages of samples taken at the top of every hour. These are not gusts. Newer equipment, particularly the Automated Surface Observation System (ASOS) used at most locations since 1996, automatically records these values from cup anemometer values. Older observations (prior to 1996) represent data recorded by personnel working at weather stations that manually observed wind speed and direction at the top of every. The software used to generate these high-quality wind roses is courtesy of Lakes Environmental Software and is called WR-PLOT.

Source: Natural Resource Conservation Service, Wind Rose Data, www.wcc.nrcs.usda.gov/climate/windrose.html

Wind Rose for Athens, Georgia



APPENDIX E: CANCER AND BREAST CANCER FACTORS

Cancer

Cancer is a group of more than 100 anomalies characterized by uncontrolled growth and spread of abnormal cells. Each type of cancer is usually not caused by only one factor, but is almost always caused by a combination of factors. Some of these factors, such as lifestyle choices, can be controlled. General lifestyle choices such as using tobacco, drinking alcohol, lack of a healthy diet, and lack of exercise are high risk factors in developing cancer. Some factors, such as age genetics (family history), and race cannot be controlled. As we age, the body's ability to respond to various cancer triggers decreases, making it more common for cancer to occur in older people regardless of the type of cancer diagnosed. Also, families with a history of cancer have higher risk of getting cancer.

A cancer cluster is the occurrence of greater numbers of the same type of cancer cases than expected within a period of time and within a geographic area. Cancer clusters are often suspected when people learn that cancer has been diagnosed in several friends, family members, or neighbors. Cancer clusters are also sometimes suspected when people work together or have some other factor in common and are then diagnosed with cancer. Because all cancers are not caused by the same factors, most reported cancer clusters have been found to be chance occurrences, and not related to environmental factors.

Reported clusters of any kind, including suspected cancer clusters, are investigated by epidemiologists (scientists who study the frequency, distribution, causes, and control of diseases in populations). Epidemiologists use their knowledge of diseases, environmental science, lifestyle factors, and biostatistics to try to determine whether a suspected cluster represents a true excess of cancer cases.

Cancer cluster investigations are conducted to verify that an unexpected number of cases of cancer have occurred. If a cause can be determined, measures can be taken to eliminate the cause. A true cancer cluster must meet the following criteria before it can be considered a true cancer cluster, and if any of these criteria are not met, it is not a cancer cluster. A cancer cluster exists if:

- A large number of cases of a specific type of cancer, rather than several different types;
- A rare type of cancer, rather than common types; or
- An increased number of cases of a certain type of cancer in an age group that is not usually affected by that type of cancer.

The Georgia Comprehensive Cancer Registry has developed strategies for active cancer surveillance. This systematic approach to monitoring cancer trends leads to more opportunities for prevention and control of cancer in Georgia.

Breast Cancer

Breast cancer is the most common form of cancer (other than skin cancer) and a leading cause of cancer mortality among women in the United States [1, 3, 8]. Breast cancer rates in the United States are among the highest in the world. Studies of migrants who move from low-incidence areas to high-incidence areas have found that the rates of breast cancer increase to that of the new country, reflecting changes in lifestyle and environmental factors, showing that international differences in rates are not due to genetic factors [1]. While many factors have been associated with the risk of breast cancer, most of the known risk factors for breast cancer are associated with only a moderate two to three times increased risk, suggesting that multiple factors may play a role in each woman's disease and that

unrecognized factors may exist. In addition, only a small proportion of the cases are accounted for by known risk factors [1].

Both genetic and environmental factors are believed to play a role in a woman's risk of developing breast cancer. If either a woman's mother or sister has breast cancer, the woman's risk increases about two to three times [1, 2, 3, 5, 6]. Having both a mother and a sister with breast cancer increases a woman's risk up to six-fold [1, 5, 6]. If that relative had cancer in both breasts or was diagnosed at an early age, the risk may be further increased. In small groups of families, the patterns of breast cancer incidence seem to be consistent with known patterns of genetic inheritance. Scientists have found breast cancer gene and have successfully cloned it [1].

Racial differences also play a role in cancer incidence. [3] From 1973 to 1991, invasive breast cancer incidence in the United States increased 25.8 percent in whites and 30.3 percent in blacks, or roughly 2 percent per year [1]. The reason for the increase in breast cancer incidence is not clearly understood, and may be partly explained by early detection, however there may be changes in other breast cancer risk factors [1, 3].

It is well recognized that certain reproductive events, and the age at which they occur, are strong determinants of subsequent breast cancer risk. The most consistent determinant of risk in various populations is the woman's age at first full-term pregnancy. Women with a first full-term pregnancy after age 30, and women who have never borne a child have about a two- to three-fold increased risk of breast cancer compared to women having a full-term pregnancy before age 20 [1, 3].

Women who are delaying childbirth or remaining childless have increased risk of breast cancer. Early menarche and late menopause also increase a woman's risk, while removal of both ovaries, before menopause, reduces risk. Several recent studies suggest that more than one birth in a row is associated with a reduction in the risk of breast cancer [2, 3]. The effects of breastfeeding is still not clear, although there is the suggestion that breastfeeding reduces risk of breast cancer [1, 3]. These reproductive factors are often thought to affect the risk of breast cancer by their effects on a woman's hormonal status.

Because of the relationship between hormones produced by the body and breast cancer risk, much concern has been raised about the use of exogenous hormones. Most studies suggest no effect from oral contraceptive use on breast cancer incidence [1, 3]. However, some recent studies suggest a possible increase in breast cancer at an early age (before age 45) among long-term oral contraceptive users, and those who started taking oral contraceptives at a young age. There is also evidence that use of estrogen replacement therapy may slightly increase the risk of breast cancer, particularly among long-term users and those who used high doses of estrogen [1, 2]. Further study of the effects of oral contraceptives and hormone replacement therapy is needed, as any associated increases in risk could affect many women.

Incidence rates increase dramatically with age. While the rate of increase in breast cancer incidence is greatest in women under age 50, the majority of cases occur after age 50 [1, 3]. Incidence rates in women before the age of 45 are higher among blacks; after the age of 45, they are higher for whites [1, 3].

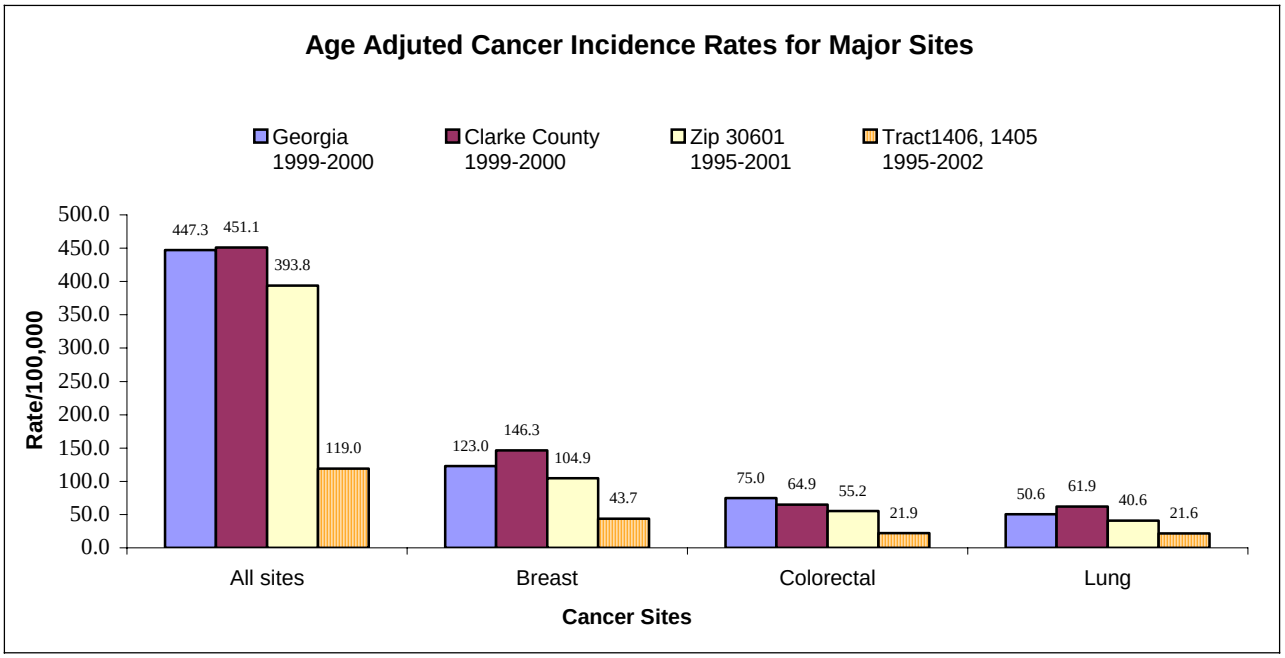
Studies reported a weak increase in breast cancer risk among women consuming high fat diets, while several large prospective studies that evaluated effects of adult dietary fat intake show little if any association with breast cancer risk [1, 3].

Cancer in Georgia

Cancer is very common in the U.S., and many cancers are preventable. One in two males, and one in three females are expected to develop cancer in their lifetime [5, 6, 9]. For 2000 and 2002, 1/3 of approximately 550,000 cancer deaths expected were projected to be related to nutrition, physical inactivity, smoking and alcohol use, and other lifestyle factors, and could have been prevented [7,8]. Environmental pollution is attributed to less than 2% of all cancer deaths [2, 4, 10]. 77% of diagnosed cancers occur after age 55, and up to 10% of cancers are hereditary [5, 6]. In Georgia in 2000, 8% of all cancer deaths were due to breast cancer [5]. Additionally, blacks in Georgia are 27% more likely to die of cancer than whites [5, 6].

Breast cancer among women is very common in the U.S. and in Georgia, and risks of developing breast cancer greatly increase with age, lifestyle, estrogen hormone use, and heredity [8, 12]. In the United States, breast cancer accounts for 31% of all new cancer cases, but only 15% of deaths. Breast cancer incidence in Georgia is less than an most other states in the nation, and age adjusted breast cancer mortality rates have remained unchanged since 1930 [6].

Cancer incidence and mortality rates in Georgia, Clarke County, Madison County, and Oglethorpe County are comparable, although mortality in Madison County is slightly higher than the state rate. Incidence and mortality in women overall, and breast cancer specifically, is less than the state rate in Madison and Oglethorpe counties, however is slightly higher for Clarke County [9]. It should be noted that data for these counties is reportedly only 48% complete and may not reflect all cancer incidence and mortality [10].



Source: Georgia Department of Human Resources, Division of Public Health, Comprehensive Cancer Registry, 8/31/05.

Zip code data for the Pittard Road community show that zip code 30601 cancer incidence rates for all sites on the body are less than the expected rates for the state of Georgia (393.8), but that tract data for 1406 and 1405 combined are less than half the expected rate (119) [10]. Incidence rates for breast, colorectal, and lung cancers followed this same pattern [10]. All zip code and tract data are given are age adjusted per 100,000 people [10].

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APPENDIX F: RADON

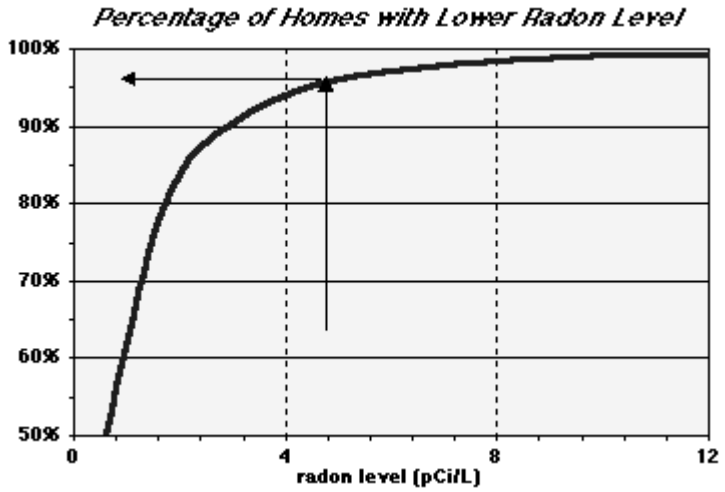
Radon levels in U.S. homes

Radon is a naturally occurring radioactive gas that is odorless and tasteless. It is formed from the radioactive decay of uranium. Uranium is found in small amounts in most rocks and soil. It slowly breaks down to other products such as radium, which breaks down to radon.

When relaxing at home, we breathe in radon. It is soluble in blood and circulates through the body and all organs. Some tends to accumulate in fatty issues. Then, almost all is harmlessly exhaled by lungs or skin. But radon decay products, radioactive solid particles, much smaller than household dust, float in the air and get trapped in our lungs, trachea, and bronchi. Exposure to high levels of radon may result in an increased incidence of lung diseases, such as emphysema, pulmonary fibrosis, and lung cancer.

Outdoor radon levels in the U.S. range from 0.02 to 0.75 pCi/L (picoCuries per liter), averaging 0.4 pCi/L. But homes draw concentrated radon gas from the ground. Because radon is nine times heavier than air, elevated radon levels build up in basements and on lower floors. Although the U.S. Congress has set the natural radon concentration outdoors as the target level for homes, approximately two thirds of homes exceed it. A half of American homes have a radon level above 0.67 pCi/L (the median level). The average (mean) radon level in US homes is 1.25 pCi/L, or three times higher than the average level outdoors.

Nearly 8 million US homes, or one out of every 15, have radon levels above the EPA's 4 pCi/L "action" limit and nearly one out of six homes exceed the EPA's 2 pCi/L "consider action" limit.



It is difficult for people to accept that their home, a place that one looks to for security, is hiding invisible danger. Yet, the average person receives a higher radiation dose from radon at home than from all other natural or man-made sources combined**.**

How about all the other radiation around us?

Background radiation levels are a combination of terrestrial (radium, thorium, radon, etc.) and cosmic radiation (photons, nutrons, etc.) Natural radioactivity is common in the rocks and soil that make up our planet – over 60 radionuclides (radioactive elements) can be found in nature. Sunshine is a radiation. The visible light is in the middle of its range of wavelengths. The long-wave radiation is infrared and it warms the skin. The shortest wavelength is ultraviolet radiation which causes skin cancer.

Beyond the ultraviolet radiation is a higher-frequency radiation emitted from nuclei of unstable radioactive atoms - ionizing radiation**.** It has enough power to knock out electrons from atoms and convert them to electrically charged ions, which can damage the large molecules of living cells. Ionizing radiation damages DNA and just one mutant cell can cause cancer. Radon decay chain offers a full menu of ionizing radiation: alpha and beta particles, and gamma rays. (Nuclear explosions emit one more radiation - neutrons.) Cosmic radiation consists of a variety of very energetic particles, including protons, nutrons, and neutrinos, which bombard the earth from outer space. Radioactivity is all around us and also within us.

However, two thirds of the total effective radiation dose to the average American from all natural sources comes from radon. Radon in homes is more concentrated and far more dangerous than outdoors - the National Academy of Sciences estimates that the outdoor radon causes only 800 out of the total of 21,000 lung cancer deaths caused by radon in the US each year.

Official limits on radon levels

Although radon in homes has been declared a national health problem, there are no federal or state standards. The Environment Protection Agency was given the task of developing practical guidelines. Considering the high cost of mitigation methods available to homeowners in 1980s, EPA did not want to force homeowners to install costly radon mitigation systems, leaving the decision up to each homeowner. But at the same time, EPA has made it clear that the 4 pCi/L action limit is not a "safe" level and warned the public:

Any radon exposure has some risk of causing lung cancer. The lower the radon level in your home, the lower your family's risk of lung cancer.

How safe is the 4 pCi/L radon "action limit"?

People spend most of their time at home - on average 70%, but more in case of women and particularly, children. Although the 4 pCi/L level has become a benchmark for real estate transactions, it still carries risks. The most substantial epidemiological study ever on the link between residential radon and lung cancer was published the University of Iowa in 2000. This 5-year study proves that radon even at the low levels found in homes causes lung cancer and that the risk is proportional to the radon level. The study shows that the exposure of adult women to radon over 15 years at the EPA "action" level of 4 pCi/L increases the lung cancer risk by 50 percent**.**

Sources: ATSDR, ToxFaqs™ For Radon; www.radonseal.com; www.cheec.uiowa.edu/misc/radon.html.