Public Comment Release

Transcontinental Gas Pipeline Company
Comer, Madison County, GEORGIA

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Prepared by:
Georgia Division of Public Health

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Prepared under a Cooperative Agreement with the
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333
THE GDPH PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment-Public Comment Release was prepared by the Georgia Department of Community Health, Division of Public Health (GDPH) under cooperative agreement with the Agency for Toxic Substances and Disease Registry (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, GDPH 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. This document represents the agency’s best efforts, based on currently available information, to fulfill the statutory criteria set out in CERCLA section 104 (i)(6) within a limited time frame. To the extent possible, it presents an assessment of potential risks to human health. Actions authorized by CERCLA section 104 (i)(11), or otherwise authorized by CERCLA, may be undertaken to prevent or mitigate human exposure or risks to human health. In addition, GDPH will utilize this document to determine if follow-up health actions are appropriate at this time.

This document has previously been provided to EPA and the affected state in an initial release, as required by CERCLA section 104 (i) (6) (H) for their information and review. Where necessary, it has been revised in response to comments or additional relevant information provided by them to GDPH. This revised document has now been released for a 30-day public comment period. Subsequent to the public comment period, GDPH will address all public comments and revise or append the document as appropriate. The public health assessment will then be reissued. This will conclude the public health assessment process for this site, unless additional information is obtained by GDPH which, in the agency’s opinion, indicates a need to revise or append the conclusions previously issued.

Use of trade names is for identification only and does not constitute endorsement by the Georgia Department of Community Health.

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PUBLIC HEALTH ASSESSMENT

TRANSCONTINENTAL GAS PIPELINE COMPANY
COMPRESSOR STATION #130
Madison County, Georgia

EPA ID: 110005675439

Installation of a natural gas pipeline.

Georgia Department of Community Health
Division of Public Health

Prepared under a Cooperative Agreement with the Agency for Toxic Substances and Disease Registry, U.S. Department of Health and Human Services
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ACRONYMS

AAC Acceptable Ambient Air Concentrations
ATSDR Agency for Toxic Substances and Disease Registry
C.O.P.S. Citizens Organized for Pipeline Safety
CV comparison value
EPA Environmental Protection Agency
GCCR Georgia Comprehensive Cancer Registry
GDPH Georgia Division of Public Health
GEPD Georgia Environmental Protection Division
HSI Hazardous Site Inventory
NAAQS National Ambient Air Quality Standards
NEHD Northeast Health District
µg/m³ micrograms per cubic meter
mg/m³ milligrams per cubic meter
MGCL maximum ground level concentration
MRL minimal risk level
ppb parts per billion
NOx nitrogen oxides
PCB polychlorinated biphenyls
Transco Transcontinental Gas Pipeline Company, Compressor Station #130
VR Vital Records Office
SUMMARY

Transcontinental Gas Pipeline Company (Transco) operates a compressor station that passes through Madison County near Comer, Georgia. The Transco Compressor Station #130 serves one pipeline that transports natural gas. The Georgia Department of Community Health received a request from a community group to conduct a public health assessment for the residents near the Transco Compressor Station. Specifically, residents have health concerns regarding the potential for exposures to hazardous chemicals released to soil, groundwater and air from compressor station operations.

This public health assessment contains information about the extent of contaminated soil, groundwater, and air, and conclusions about risks to public health. A public health assessment is designed to provide information about the public health implications of a specific site and to identify populations for which further health actions or health studies are needed. It is not intended to serve the purpose of or influence any other environmental investigation such as risk assessment or selection of remedial measures, or to address liability or other non-health issues.

This document only considers public health issues for off-site human exposure that has or may have occurred, is or may be occurring, or may occur in the future. Employees of facilities under investigation are not included in our exposure assessment because federal laws that protect workers are not the same as those for protecting the general public. Other agencies are mandated to protect workers, and addressing employee exposure is not within the authority of GDPH. If employees of Transco are concerned about exposure to on-site contaminants, they should report these concerns to the U.S. Occupational Safety and Health Administration.

GDPH concludes that exposure to contaminants present at this site are not expected to harm people’s health because the public has not been, are not currently, and are unlikely to be exposed to environmental contamination from facility operations. Specifically,

1. Soil contamination has been contained on-site in restricted access areas, and to undeveloped woodland of Transco property not easily or reportedly accessed by the general public.
2. Sediment contamination is limited to on-site drainage ways and a creek on Transco property in areas not used for recreation.
3. There is no off-site groundwater contamination from facility operations.
4. The facility has consistently remained in compliance with air emissions regulations.
5. Formaldehyde emissions from this facility are not at levels that pose a health hazard to nearby residents.

No further public health actions are recommended at this time. If additional data become available, the information will be reviewed by GDPH, and appropriate actions will be taken.
STATEMENT OF ISSUES

The Georgia Department of Community Health, Division of Public Health (GDPH), received a request from a community group to conduct a public health assessment for the residents near the Transcontinental Gas Pipeline Company Compressor Station #130 (Transco) near Comer in Madison County, Georgia. Some residents living near this Transco compressor station have expressed health concern about the potential for exposures to hazardous chemicals released to soil, groundwater and air from facility operations.

In response, GDPH reviewed residents’ concerns, environmental sampling data, and health outcome data to assess whether exposure to contaminated soil, groundwater and air has occurred, is occurring, or may occur at levels of health concern. The purpose of this public health assessment is to evaluate whether exposure to contaminants released to the environment from Transco operations represent a health hazard to residents living near the facility.

The two other petroleum pipelines located in Madison County were also investigated to address concerns about health and safety issues associated with petroleum product transportation. Detailed information about these two pipeline facilities, including any recommendations for additional public health actions is included in Appendix A.

BACKGROUND

Site Description and History

The energy transportation network of the United States consists of over 2.5 million miles of pipelines. These pipelines are operated by more than 3,000 private, small and large companies. According to the federal Department of Transportation, the network includes approximately:

- 168,900 miles of liquid petroleum pipeline
- 320,500 miles of gasoline transmission pipeline
- 2,200,000 miles of natural gas distribution pipeline

Natural gas provides 24% of our country’s total energy consumption [U.S. Department of Transportation, 2010; www.phmsa.dot.gov/public]. Georgia produces no natural gas and has no proven reserves of natural gas. Therefore, we must rely on imports to meet demand. Because such huge volumes of natural gas must be transported, the only feasible way to do so is through pipelines. Natural gas distribution systems consist of distribution main lines and service lines. Distribution main lines are generally installed in underground utility easements alongside streets and highways. Distribution service lines run from the distribution main line into homes or businesses. Pipeline operators are required to post brightly-colored markers to indicate the presence of – but not necessarily the exact location of – their underground pipelines. They contain information about the nearby pipeline as well as emergency contact information for the company that operates it.
The Transcontinental Gas Pipeline Company operates interstate pipelines transporting natural gas products from Texas, Louisiana, and Mississippi, and the Gulf of Mexico to locations throughout the southeast and eastern states. The total area covered is 10,100 miles. Transco is a subsidiary of The Williams Companies, Inc., which is the largest volume-transporter of natural gas in the United States. One of the pipelines passes through Madison County, Georgia.

Transco operates a pipeline compressor station in Madison County on Transco Road, approximately five miles northeast of Comer, Georgia (Figure 1). The pipeline and compressor station have been in continuous operation in Madison County since 1952. This facility is one of the 44 compressor stations that pressurize the natural gas to facilitate its transmission to higher level compressor stations along the eastern United States [1]. The site is fenced, has 24-hour staffed security and surveillance, and does not permit unauthorized access to the property.

Natural Gas Compressor Station Description

Compressor stations are the "engine" that powers an interstate natural gas pipeline. As the name implies, the compressor station compresses the natural gas, (increasing its pressure) to push the gas through the pipeline.

Pipeline companies install compressor stations along their pipelines, typically one every 40 to 100 miles. The size and the number of compressors vary, based on the diameter of the pipe and the volume of gas to be moved. When the natural gas enters the compressor station, it flows through separators used to remove solids and liquids from the natural gas in the pipeline. These separators are provided mainly to protect the compressor from any small debris that has gotten into the pipeline during construction and water from integrity testing. It should be noted that
except for the small amount of debris and liquids captured to protect the compressors, and the natural gas needed to run the compressor station, all the natural gas that enters a compressor station leaves it again through the pipeline.

After going through the separators the natural gas is then compressed. The compressor is driven by a gas turbine or internal combustion engine. A turbine engine is very similar to a jet engine found on an airplane except that instead of using the thrust to push the airplane, the gas turns a large fan to spin or rotate the compressor. An internal combustion engine is similar to a car engine, just larger. The gas turbine and internal combustion engines typically use natural gas from the pipeline for power.

There are several buildings on the approximately 250-acre Transco property that store compressed air in Air Receiver Tanks and in converted scrubber oil tanks. The facility also has three main drainage ditches that were once used to collect liquids around the compressor buildings.

The Transco compressor station has 21 internal combustion engines and two turbine engines:
- Internal combustion engines
  - 3 auxiliary (emergency) generators installed in 1950 (200 hours/year/engine)
  - 16 mainline units installed from 1951 through 1971
  - 2 air compressors installed in 1966
- Turbine engines
  - turbine T1 was installed in 1980
  - turbine G1 was installed in 1990

Note: for safety and security, no photographs of Transco or other identified compressor station are included in this document.
Natural Resources Use

This compressor station is surrounded by gently rolling hills covered with hardwood and pine forests, open fields, and single family residential properties (Figure 2). There are approximately 40 homes within a one-mile radius of Transco. There are no schools, day care centers, nursing home or other sensitive population centers reported within a one-mile radius of the facility.

Groundwater at the site was encountered in the saprolite (shallow) aquifer at approximately 20 to 28 feet below ground surface. Groundwater flow is predominantly to the north/northeast. The horizontal velocity was calculated to be 80 feet per year. Groundwater in the vicinity of Transco is used as a source of potable groundwater. There are two water wells owned by Transco, including one well at the station and another at the nearby company housing, also located on Transco property. However, these wells are no longer used for drinking water. Specifically, the station’s drinking water well has been replaced by county water and the company housing is not occupied. Residential wells are the primary source of drinking water within a one-mile radius of the Transco facility. The nearest residential drinking water well is less than 0.5 miles from the facility property line.

Several creeks, tributaries, and drainage ditches are located on and adjacent to Transco. These include the Cedar Grove Branch (Stream) and Scull Shoal Creek (Figure 3).

Regulatory History

The U. S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration, has overall regulatory responsibility for hazardous liquid and gas pipelines under its jurisdiction in the United States\(^1\). (For more information about pipeline safety in Georgia, contact the Pipeline and Hazardous Materials Safety Administration Southern Region Office at 233 Peachtree Street, N.E., Suite 600, Atlanta, Georgia 30303; Telephone: 404-832-1140.)

Transco’s natural gas transportation and storage operations are subject to the National Environmental Policy Act and numerous federal, state and local environmental laws, regulations, and ordinances governing the discharge of hazardous substances into the environment, the security of chemical and industrial facilities, and public health and safety. These laws include:

- The Federal Clean Air Act and analogous state laws, which impose obligations related to air emissions.
- The Federal Water Pollution Control Act of 1972, as renamed and amended as the Clean Water Act and analogous state laws, which regulate discharge of wastewaters from facilities to state and federal waters.
- The Federal Comprehensive Environmental Response, Compensation, and Liability Act (also known as Superfund), and analogous state laws that regulate the cleanup of

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hazardous substances released to the environment from a facility or locations where wastes were sent for disposal.

- The Federal Resource Conservation and Recovery Act, and analogous state laws that impose requirements for the handling and discharge of solid and hazardous waste from facilities.

- The Toxic Substances Control Act requires reporting, record-keeping and testing requirements, and restrictions relating to chemical substances and/or mixtures.

Various governmental authorities, including the U.S. Environmental Protection Agency (EPA) and analogous state agencies, and the United States Department of Homeland Security have the power to enforce compliance with these laws and regulations and the permits issued under them.

The Georgia Department of Natural Resources, Environmental Protection Division (GEPD), is the state regulatory authority that oversees Transco operations and permitting at the state level. GEPD conducts unannounced inspections every year (EPA requires every other year), and complaint investigations. GEPD’s regulatory requirements for Transco include:

1. Monitoring and record keeping;
2. semi-annual submittal of deviations from the permit, and
3. annual compliance certification for each permit condition.

For questions about regulatory compliance, please contact the GEPD site lead, Dr. Montague McPherson, at (404) 657-8600.

Safety

Natural gas compressor stations have a risk of fire because their operating environment includes a combination of heat, pressure and vibration. Although compressor station accidents are extremely rare (four in Georgia since 1972 with no injuries or fatalities), there is always the potential for accidental gas leaks within the station. At Transco, there was an explosion and fire in the turbine building in 2003 when a mechanical failure of a turbine component allowed the release of high pressure gas into the turbine building. All safety systems worked as they were supposed to and the gas entering the building was shut off within eight seconds and vented. The fire was quickly extinguished within minutes. There were no injuries and all damage was confined to the turbine building and turbine. The company operates several of this same model of turbine, and failures of this nature are extremely rare [Transcontinental Gas Pipeline Company, April 16, 2010]. The incident was properly reported as required. The incident posed no health hazards to the public.

GDPH reviewed the extensive safety procedures and requirements for Transco and determined that the Transco natural gas pipeline system in Georgia does not pose a public safety hazard above and beyond the intrinsic hazards associated with distribution of natural gas. For more information about the safety of natural gas pipelines, visit the National Transportation Safety Board at www.ntsb.gov.
Environmental Sampling Summary

Note: This document only considers public health issues for off-site human exposure that has or may have occurred, is or may be occurring, or may occur in the future. Employees of facilities under investigation are not included in our exposure assessment because federal laws that protect workers are not the same as those for protecting the general public. Other agencies are mandated to protect workers, and addressing employee exposure is not within the authority of GDPH. If employees of Transco are concerned about exposure to on-site contaminants, they should report these concerns to the U.S. Occupational Safety and Health Administration.

The normal transmission of natural gas generates wastes, called natural gas pipeline condensate. Until the early 1970s, Transco used lubricants containing polychlorinated biphenyls (PCB), a probable human carcinogen. These lubricants were used solely in the station’s starting air system compressors for safety reasons: PCBs have a high flash point, meaning they do not easily vaporize to form an ignitable mixture in air. At that time, condensate and used lubricant waste material was buried in on-site pits and burned, resulting in hydrocarbon- and PCB-contaminated soil on site [2]. There are no air sampling data that can be used to evaluate the potential health effects from exposure to gas and particulates emitted to air from open burning events. Transco records indicate that the use of PCB-containing lubricants was discontinued in 1975. The manufacture and distribution in commerce of PCBs was banned in the United States in 1976.

The toxic heavy metal mercury was also used by Transco for the metering stations, and leaks caused mercury contamination of on-site soil [2]. In 1989, Transco converted its systems to electronic flow measurement meters, thus eliminating the need for mercury. Soil analyses results for mercury at the Transco facility showed mercury contamination was confined to specific, small areas of on-site soil. The type of mercury (elemental), and the low levels found did not require remediation under EPA’s Toxicity Characteristics Leaching Procedures [2]. GDPH does not consider exposure to mercury in on-site soil from former Transco operations to be a public health concern.

In 1988, the discovery of residual PCBs in starting air system condensate resulted in Transco implementing corrective actions to prevent discharge into soil. In response, Transco initiated a system-wide sampling program and the results of this investigation were submitted to GEPD and EPA, and a release notification was provided to GEPD. Starting air systems were decontaminated by an independent contractor using an EPA-permitted process and fenced off by 1992, thus eliminating on-site exposure to contaminated soil in this area. Remediation (cleanup and disposal) of contaminated soil followed [2].

Between 1990 and 1992, Transco evaluated the on-site water management system. Water management drainage ways were used from 1949 to 1988 to manage roof and yard storm water, building basement water and equipment drains. The system was evaluated by pipe testing and soil sampling at 30 foot intervals at soil depths up to 90 inches (approximately 170 samples). PCBs were detected above regulatory and/or health guidelines in approximately 18% of samples; lead in one sample, and arsenic in 45% of samples. Remediation of on-site drainage way contamination was conducted in 1994 [2].
In 1991, GEPD sampled seven wells for PCB within a one-half mile radius of the Transco facility. PCBs were not detected in any of these wells or in any on-site drinking water wells [3].

In July 1992, an independent contractor prepared a public health risk assessment and fate and transport assessment report for soil and sediment samples showing PCB contamination. The report also examined the fate and transport of PCBs to predict migration patterns in soil and sediment to determine if PCB deposition and accumulation could affect risk-based target clean-up levels. Results indicated that on-site contamination evaluation risk values were within the range of EPA acceptable cancer risk criteria. There were no contaminants found off-site at levels of health concern [4].

In 1993, Transco submitted an application to GEPD to expand their permit operations [5]. This application contained air dispersion modeling to ascertain the nitrous oxides (NOx) emissions for their Solar MARS® turbine engine. Five modeling sets were run and included five years of meteorology. Modeling indicated that, at that time, NOx emissions would not produce a significant impact off site, and were less than one percent of the damaging level. For more detailed information about analyses of air emissions, please see the Air Emissions section below.

The site was listed on the GEPD Hazardous Site Inventory in June, 1994 for release of PCBs in soil [6].

In November 1994, Transco submitted a work plan requesting a Nationwide Permit Authorization from the U.S. Army Corp of Engineers. This was because soil remediation activities would impact 0.04 acres of wetlands for the removal of approximately 350 cubic yards of PCB-contaminated soil [7]. Transco property contained waters of the United States under the jurisdiction of the Clean Water Act that required federal authorization. The work plan dealt with residual PCBs and other compounds at GEPD’s Hazardous Site Response Act notification levels. The request was approved for two years. (For more information about the Hazardous Site Response Act, visit www.gaepd.org/Documents/hsraguideCSRRRS).

In January 1995, Transco submitted a work plan to EPA for additional site characterization, soil remediation of PCBs and other contaminants, and building and equipment surface PCB decontamination. EPA approved the work plan in April 1995 and specified remedial standards for drainage ditch sediments and stream and creek sediments. The remedial activities outlined in the work plan were voluntarily initiated in 1995 and completed in 1997. The release of PCBs to soil was confined to areas beneath air receiver tanks, drain lines, and drainage ways. In September, 1995, off-site soil was sampled in drainage ways for PCBs and no PCB contamination was found [8].

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2 The Hazardous Site Inventory (HSI) is a list of sites in Georgia where there has been a known or suspected release of a regulated substance above a reportable quantity and which have yet to show they meet state clean-up standards found in the Rules for Hazardous Site Response. More information about the HSI can be found at www.gaepd.org/Documents/hazsiteinv.
In fall 1995, off-site soil and sediment samples were collected from private property approximately 50 yards from, and down gradient of, the Transco property. This investigation was conducted by an independent contractor. Samples were analyzed for PCBs, total petroleum hydrocarbons, and metals (arsenic, mercury, chromium and lead), and no contaminants were found at levels exceeding any regulatory or health values [9].

The soil and sediment investigations revealed that PCB-contaminated soil was restricted to company-owned property. Therefore, no exposure to contaminated on-site soil has occurred for the general public.

In February 2002, the U.S. Department of Justice and EPA announced a settlement with Transcontinental Gas Pipeline Company for violations of the Resource Conservation and Recovery Act, Clean Water Act, and Toxic Substances Control Act at various locations throughout the Unites States. The civil penalty was assessed at $1.4 million and included the remediation of PCB contamination, completion of a storm water monitoring program, and the sampling of storm water at several compressor stations along its natural gas pipeline, including the Madison County facility [10].

Since April 2005, six on-site groundwater wells have been installed and groundwater is being monitored as part of long-term site assessment activities. Monitoring frequency varies, but each well has been sampled several times per year. Arsenic continues to be detected at levels exceeding regulatory and health guidelines inconsistently in one well. Arsenic has never been detected in the monitoring well located immediately down gradient of that well during any sampling event [11].

The cause of the elevated arsenic concentration in some groundwater sampling events is unknown. A review of historical assessment data for soils in the vicinity of elevated arsenic shows that no source of arsenic is apparent. However, to further investigate the possible source of the sporadic arsenic being measured in the vicinity of this groundwater monitoring well, Transco is conducting an arsenic source investigation [11]. The source investigation will include additional soil sampling and groundwater monitoring adjacent to the monitoring well where arsenic has been detected.

GDPH believes that the sporadically-observed elevated levels of arsenic are not indicative of a groundwater plume and, at this time, do not pose a risk to nearby surface water or residential drinking water sources. GDPH will evaluate additional groundwater data as it becomes available, and conduct public health protection measures, if needed.

Based on the location of current drinking water wells at the station, the data analyses results, and groundwater gradient, there is no current exposure. The presence of arsenic has been defined and shown to be localized and confined to company property. The station’s drinking water is now supplied by the county. Groundwater monitoring results will be examined by GEPD to ensure that exposure to contaminated groundwater does not occur.
Because of the isolated and intermittent nature of the arsenic contamination at this one on-site well, the low levels of arsenic contamination, the ongoing source investigation, rigorous monitoring plans, and regulatory scrutiny, GDPH considers exposure to arsenic-contaminated groundwater unlikely.

In summary, over 15,000 environmental samples were collected and approximately 13,500 tons of contaminated material was remediated at the Transco site (Appendix B). Many of the assessment and remedial activities were to address PCBs, but hydrocarbons, mercury, lead, and arsenic contamination were also addressed. In all instances:

- The use and releases of regulated constituents occurred when such releases were legal and the possible health hazards and/or environmental impacts were not well understood.
- State and federal regulatory agencies were voluntarily notified of these findings when they were discovered by Transco.
- Transco used conservative assessment procedures to define the extent of the releases (typically a six foot sample grid spacing) and used conservative clean-up standards to protect Transco workers, the public, and the environment.
- Transco solicited state and federal agency input and/or oversight prior to conducting voluntary remedial activities.
- All sampling and remediation work to date has been reviewed and approved by the EPA.
- Transco consistently provides required, complete documentation to GEPD and EPA on a timely basis.

Soil and groundwater contamination have been contained on-site in restricted access areas, and to undeveloped woodland of Transco property not easily accessible and rarely accessed by the general public. Sediment contamination is limited to on-site drainage ways and a creek on Transco property in areas not used for recreation.

**COMMUNITY HEALTH CONCERNS**

Community concerns were gathered using various methods; primarily, interviews with residents and government agency staff, and reviews of historical information, similar issues in other states, and local media coverage. NEHD staff attended numerous meetings of a local community group over several years to help document community health concerns regarding Madison County petroleum pipe lines. GDPH staff also attended these community group meetings during the initial phases of the Transco public health assessment process to document their health concerns and encourage members’ input in designing methods to gather and address health-related concerns of other residents.

In addition, over several years GDPH and other agency staff received dozens of emails from a leader of the community group detailing her specific concerns about the Transco facility. No other residents, site-related homeowners’ associations or other community groups, elected officials or community leaders contacted us or other agencies with health concerns during the public health assessment process. Therefore, GDPH concludes that there is a low level of community concern regarding the Transco facility. To be protective of the residents of Madison
County, GDPH considered the concerns expressed by the community group members as representative of the specific health concerns of the community at large.

**Citizens Organized for Pipeline Safety (C.O.P.S.)**

Over the last several years, some residents of Madison County contacted EPA, GDPH and GEPD with concerns about exposure to potentially hazardous chemicals and resultant health effects from petroleum pipelines and facilities. In August 2005, concerned residents formed the community group, Citizens Organized for Pipeline Safety (C.O.P.S.). This group was created to obtain and share information with other residents about safety and health hazards associated with the Colonial Pipeline facility. C.O.P.S. also related concerns about the other two pipelines in the area, Transcontinental Gas Pipeline and Plantation Pipe Line.

A brief summary of the Colonial and Plantation facilities can be found in Appendix A, including a letter from the Madison County Board of Commissioners requesting that GEPD inform them of these companies’ excavation activities (Appendix A-1). In addition, GDPH published a public health assessment for the Colonial Pipeline Booster Station in June 2006. For spatial and geographic reference, Appendix A-2 is a map submitted to GDPH by C.O.P.S. showing the number of land parcels in Madison County (approximately 3,600) within a half mile of the three pipelines, and associated facilities [Georgia Department of Transportation, Northeast Regional Development Council; 2009].

**Community Health Assessment Activities**

At a May, 2006 public hearing for the Transco Air Permit Application Review, several residents provided formal comments to GEPD. These comments and GEPD’s responses can be found in the addendum at www.pstrust.org/library/docs/PermitQA.PDF. Public health issues discussed during the Air Permit Application hearing include:

- Request for emission amounts to be provided in parts per million, as opposed to tons per year. Regulatory levels, chemical exposure limits, and health values are in parts per million, parts per billion, milligrams per cubic meter, etc. Therefore, it is not possible to compare the reported emission levels with applicable health outcome measures.
- Nitrogen oxides (NOx) may contribute to global warming and smog (ground level ozone) and particulates. Breathing NOx can cause health effects, damage to the lung tissue, and respiratory disease. (It is noted that Madison County is in attainment with the National Ambient (outdoor) Air Quality Standards for ozone, fine particulate matter and NOx.)
- Formaldehyde exposure in ambient (outdoor) air.

For analyses of air emissions, please see the Air Emissions section below.

In 2006, C.O.P.S. members contacted the Northeast Health District (NEHD) and requested an investigation to determine if elevated rates of cancer exist for people living near Transco. During July, staff from the NEHD, Community Health and Epidemiology Branch, conducted a community health assessment phone survey of residents within two miles of the facility. 107 local telephone numbers were collected from local tax records and called, and 51 surveys were
completed. The survey instrument allowed for query of respondents about relatives, children and other household members. Therefore, although 51 households were surveyed, health information was gathered on several times that number of people.

The demographic analyses of the survey data shows that the population surveyed is representative of the broader community [12]. Respondents were white, of both genders, and had a fairly even distribution of age groups (from under 20 years to over 80 years old). The survey found no elevated numbers of cancer cases or any other chronic disease or illness. Six cancer diagnoses were reported: “female”, breast (two cases), prostate, lymphoma, and skin cancer. [13].

C.O.P.S. members provided a list of reported cancer cases diagnosed near the facility. In response, the NEHD conducted a community health assessment. A cross-sectional study was developed to measure the amount of environmental exposure in relation to the amount of disease in the identified community. The 40-question survey tool included comprehensive questions, sub-questions, and history charts that included behavioral/environmental exposure, maternal/child exposure, occupational exposure, and medical history. This epidemiological survey was conducted by NEHD staff going door-to-door from February through April 2008 within a two-mile radius of the Transco facility.

Fifty-nine residences were identified and 37 of those households voluntarily completed a health assessment survey interview. The total sample population was 97 residents. Results indicate participants represent the local, potentially exposed population (i.e., demographic characteristics were consistent with Census data, average length of current residency was 19 years; 58% lived in Madison County for extended period) [14].

This method of community assessment is not intended to provide statistical data to evaluate the health status of a community: rather, it is expected that participants will have environmental and health concerns, symptoms and diseases, and want information. This approach is designed to identify the level of community concern in a potentially exposed population, and to document symptoms and diseases to help us focus on potential clusters for further epidemiologic investigation.

Results of the community health assessment were presented at a public meeting in April 2008. Results indicated [14]:

- The cancer morbidity rates were not found to be at unexpected levels given the ages and confounding risk behaviors of the respondents. Skin cancer cases were highly correlated with outdoor sun exposure.
- There was not a level of morbidity for respiratory or cardiovascular conditions or neoplasms that differed from other similar populations.
- An analysis of cancer data for the zip code showed no unusual rates or number of cancer cases.
- The need for further assessment of this area is not indicated by the results.
- Recommendations for a future community survey:
1) Expanding to the 2-mile radius would increase the samples size and minimize the effect of random error.
2) Questions about female reproductive health and last medical visit should be added.
3) Interventions aimed at educating the population about the health effects related to tobacco exposure and the importance of regular doctor visits, particularly preventative health screenings, should be implemented.

In addition, the survey analyses found that 24% of women reported miscarriage(s). Of these women, 75% said they had miscarriage(s) while living near the compressor station. Because of continued concerns about miscarriage rates, more information is provided in the Health Outcome Data section below.

NEHD mailed the final report to the households of the 37 survey respondents, and others, upon request. For more information about the community health assessment projects described, epidemiology services, health outcome data, and other activities conducted for the Transco site and Madison County by the NEHD, please contact Dr. Louis Kudon, Northeast Health District, at 706-583-2869.

In August 2008, a resident living approximately one-half mile from Transco submitted a water sample result showing elevated arsenic in a private drinking water well and provided a detailed description of symptoms and health concerns. The resident was urged to get tested for urine arsenic levels. A test result for urine arsenic was sent to GDPH by the resident and the result was not elevated. GDPH staff contacted NEHD requesting follow-up water sampling for the well.

In August 2008, representatives from GDPH, NEHD, EPA, ATSDR, and GEPD traveled to Madison County to view the Colonial and Transco pipeline facilities and surrounding neighborhoods. Staff drove through the areas in a van and shared information about each agency’s site involvement to date, and discussed the nature and extent of community concern and possible approaches for addressing these concerns and any potential health risks posed by the facilities’ operations.

In September 2008, GDPH agreed to conduct a public health assessment for the Transco site. This decision was based on: 1) the recently reported elevated arsenic level found in one private well; 2) reported types and amounts of facility emissions (to air); 3) a need to assess the level and nature of community concerns; 4) a lack of environmental and health education materials for the public; 5) establishing best methods for providing health intervention, if needed, and 6) because Transco is on the GEPD Hazardous Site Inventory with ample environmental data available to evaluate.

**Community Involvement Activities**

In fall, 2008 GDPH developed a “Key Contacts List” for Madison County. Key Contacts are defined as anyone who is or might be interested and/or concerned about site-related activities, health impacts, and public health actions, including the GDPH public health assessment process.
Key Contacts for this site are: federal, state, and local government staff, elected officials, community advocacy group (C.O.P.S.), businesses, churches, schools, and health care facilities. A Notice of Involvement (Appendix C) was sent to these individuals and entities to inform them about the public health assessment, encourage community involvement, and provide GDPH contact information for input, questions and concerns. GDPH did not receive any responses or inquiries after sending the Notice of Involvement.

In October 2008 and February and March 2009, GDPH and the NEHD staff were invited to meet with C.O.P.S. members and discuss the public health assessment process. To ensure that all concerned residents of Madison County are included, we agreed to gather and assess health concerns for all three pipelines, instead of limiting the investigation to residents near the Transco facility. GDPH requested input from C.O.P.S. members and asked them to help us:

- document reported health concerns
- collect existing private well sampling data
- identify people with a cancer diagnosis
- involve elected officials, the business community, and other community leaders
- develop and conduct a community needs assessment (described below)
- inform the community about the public health assessment and needs assessment survey

During the process, GDPH provided public health assessment activities updates to C.O.P.S. members. No other requests for updates were received.

### Individual Water Well Sampling

In August 2008, one resident provided water well data from a private laboratory to GDPH that showed an arsenic level of 19 parts per billion (ppb). The EPA’s Maximum Contaminant Level for arsenic in drinking water is 10 ppb. When a drinking water well is identified as having elevated levels of a regulated contaminant, follow up testing is recommended. With permission from the resident, staff from the NEHD collected additional water samples from the well on February 26, 2009. Sampling was conducted according to the guidelines provided by the certified University of Georgia (UGA) Soil, Plant and Water Laboratory. Four water samples were taken, two from the outside well tap/pre-household filter, and two from inside at the faucet tap/post-household filter. Sample bottles were labeled and delivered to the UGA Laboratory for total arsenic analysis. No arsenic was detected in any sample result (the detection limit was 5 ppb). The results were sent to the resident and no further action was requested. As part of regular well maintenance, all residents with individual water wells are encouraged to test their wells for contamination annually (information about well maintenance can be found in Appendix D).

No other individual water wells near Transco have been reported to GDPH as having elevated levels of arsenic or other contaminants and no well sampling results have been submitted.

### Community Needs Assessment

To help gather community concerns, GDPH conducted an Environmental Health Education
Needs Assessment³. An Environmental Health Education Needs Assessment is designed to assist health departments in working collaboratively with communities to identify environmental health education needs and to develop education programs to meet those needs. The needs assessment process compiles information collected from community members concerned about whether hazardous substances are in their environment, and whether environmental exposures are resulting in increased incidences of symptoms and/or illnesses associated with releases from the site.

An Environmental Health Education Needs Assessment is an inherently biased process designed to identify a population with health concerns, what those health concerns are, and how to work together to address those concerns. It is not a health study; for example, it does not provide case-control, longitudinal, or cohort study data. It reflects the health concerns of the participating community members and not the Georgia Division of Public Health, or any other public health or environmental agency.

Methodology

Community concerns were gathered by attending C.O.P.S. meetings, from a Community Environmental Health Survey, another survey sent to local officials, and interviews with residents and government agency staff. Review of local media coverage and public meeting minutes also provided information to assess the level and nature of community concerns and health education needs. A literature review was conducted for similar site-specific community health investigations nationwide (natural gas compressor stations and resulting health concerns).

Community Environmental Health Survey

Survey Development

To gather community concerns in Madison County, GDPH, NEHD and C.O.P.S. members developed an Environmental Health Education Needs Assessment survey tool. Participation in this survey was voluntary and offered at no cost to residents. The survey requested basic demographic and residency information, occupational history, symptoms, and diseases. Respondents were asked about previous medical care and diagnoses, if they had been tested for or diagnosed with cancer, or if a family member had been diagnosed with cancer. Questions were asked about their drinking water supply and if they had concerns about drinking water quality and air quality. Survey respondents were asked to describe concerns about any of the pipelines in Madison County. Respondents were also asked about their preferred methods for sharing and receiving information.

³ Using Assessment to Action: A Tool for Improving the Health of Communities Affected by Hazardous Waste, by the National Association of County and City Health Officials, www.naccho.org.
Survey Distribution and Data Collection

Approximately 300 surveys were provided to a C.O.P.S. member in April and May 2009 to distribute at several publicly accessible locations throughout Madison County. Survey drop boxes were also provided by NEHD staff. The survey was posted on the GDPH home page. The local newspaper, the Madison County Journal, published advertisements in three May, 2009 issues encouraging residents to participate and informing people where they could access a copy of the survey (Appendix E). In addition, GDPH sent a media advisory with this information to the Madison County Journal and other media resources in Atlanta and Northeast Georgia (Appendix F). In late June, a cover letter requesting participation and detailing community outreach activities, the survey, public health assessment information, a copy of the advertisement, and the press release were mailed to all the elected representatives and public officials, and other community leaders in Madison County.

Survey Data Management and Entry

Completed surveys were collected by GDPH by return mail and fax as directed on the survey. Upon receipt at GDPH, surveys were immediately separated from the cover page, which contained personal identifiers (name, telephone number, and address). Cover pages were stored in a locked cabinet and personal information was not shared with any other agency or individuals. Survey data were entered into an Excel spreadsheet for analyses.

Survey Results Summary

To date, six completed surveys were returned (2% return rate). Addresses listed on five surveys were home addresses, and one address was a workplace. Completed surveys were from addresses within approximately 10 miles of Transco and not grouped geographically.

Five respondents were female and one was male. Respondents ranged in age from 48 to 74 years and were all White, non-Hispanic. Five of the survey respondents had a college bachelor’s degree or higher. Two respondents reported limited, repeated exposure to toxic chemicals at their workplace. In addition,

1. All survey respondents reported having a private well. None reported unusual taste or smell of water from a well.
2. Madison County length of residency ranged from one to 12 years.
3. Half of the respondents reported concerns about well water quality. Concerns were chemicals seeping into aquifers and water runoff from sprays and fertilizers.
4. Two respondents were concerned about air quality and two were not concerned about air quality.
5. The specific source of environmental contamination of concern was identified by respondents to be pipelines in Madison County.
6. Five respondents have been tested for cancer, and two reported a cancer diagnosis (melanoma and prostate cancer).
7. Existing health conditions most often reported were diabetes and high blood pressure.
Although multiple survey notification methods were used, the majority of residents decided by their omission, to not participate in the survey. The sample size was too small for the health and environmental concerns expressed by those who completed the surveys to represent the concerns of the entire community. However, no other residents besides C.O.P.S. members have contacted GDPH, NEHD, ATSDR, or GEPD regarding health concerns from exposure to hazardous chemicals in the environment from pipeline operations.

Based on the lack of historical evidence of community concern, small number of requests received by agencies and others reported to GDPH, low level of community participation in the survey, and the responses regarding environmental concerns, it appears that the majority of residents of Madison County do not have health concerns about Transco and other pipelines and related facilities. Therefore, GDPH considers this issue to have a low level of community concern in Madison County.

County Officials’ Survey

In addition to the community needs assessment survey and in another attempt to gather community leaders’ health concerns, GDPH decided to again contact elected and other public officials who represent residents of Madison County. In February, 2010, GDPH sent a second letter informing county and municipal officials about the public health assessment for Transco, a one page survey to assess concern regarding the Transco facility, and questions about water and air quality concerns for Madison County.

County Officials’ Survey Results Summary

Eighteen surveys were mailed and three surveys were returned. All respondents stated that they had health concerns regarding Transco. Two respondents reported concerns about environmental exposures in the community. None identified any specific chemical or contamination source or health outcome.

Strengths of the Needs Assessment Project

GDPH worked with C.O.P.S. members to ensure that this community outreach project was communicated to the public. The survey development was a collaborative effort between GDPH, NEHD, and some C.O.P.S. members, with multiple opportunities for providing input and designing survey questions and distribution methodology. One C.O.P.S. member contacted local businesses and identified potential distribution centers to help ensure that the target populations would be reached.

Three half page notices were placed in the Madison County Journal describing the survey project goals, where it was available, and GDPH placed the survey on its website where anyone could download the survey. Local newspapers published articles about the survey availability.
The majority of respondents answered most questions, including questions about self-reported medical care, symptoms, and diseases.

The survey tool was designed with format and content used in surveys previously distributed throughout Georgia in similar communities with real and potential exposures to environmental contaminants. Historically, this survey tool and process has a greater than 20% response rate.

Limitations of the Needs Assessment Project

Although findings described in this report are the result of a systematic, proven process, limitations do exist.

The method used to distribute the surveys to the community was an effective method to solicit multiple responses, yet we were not able to evaluate how many surveys were actually distributed. Although a C.O.P.S. member volunteered to distribute the surveys to potentially interested participants, no reports regarding actual survey distribution were provided to GDHP, and the C.O.P.S. volunteer ceased communicating with GDHP. However, the additional survey notification and distribution methods discussed above are considered acceptable for reaching a large number of individuals; therefore, we assume that the majority of community members decided, by their omission, not to participate in this project.

The health and environmental concerns expressed by those who completed the surveys may not represent the concerns of the entire community.

The survey’s length and verbiage may have also affected the level of participation. A long survey may not have as high of a response rate as a short one. Generally, written surveys also have a low response rate, typically about 15%.

HEALTH OUTCOME DATA

Following the results of the NEHD Community Health Survey discussed above, C.O.P.S. members continued to contact GDHP with concerns about:

1. rates for cancer cases and cancer deaths,
2. reports of children living near pipeline facilities recently diagnosed with leukemia, and
3. the number of miscarriages.

C.O.P.S. and other community residents reported women with breast cancer, all living on the same road within a mile of Transco. Another resident reported 26 cancer cases within a 1.7-mile area of the station. And other residents reported that “the frequency of breast cancer and reproductive problems among unrelated people in the Transco area is alarming.”

Cancer Data

Cancer will affect 1 in 2 men and 1 in 3 women in the United States, according to statistics collected by the Surveillance Epidemiology and End Results program at the National Cancer
Institute [www.seer.cancer.gov]. A common misconception arises from news stories suggesting we are experiencing a cancer "epidemic." This only appears to be the case because the number of new cancer cases reported is rising as the population is both expanding and aging. Older people are more likely to develop cancer; however, this trend is offset by new births, which are also increasing, and cancer is rare among the young. So as more members of a 75-million-strong "baby-boomer" cohort begin shifting to older, more cancer-prone ages, the number of new cancer cases is expected to increase in the next several decades. But since the birth rate is also expected to increase, the cancer rate may either stay the same or, perhaps, decline.

Previous cancer incidence data analyses and epidemiologic assessments by NEHD did not show any unusual numbers or rates of cancer, including leukemia, for residents living near Transco.

Investigating potential cancer clusters in Georgia is a responsibility of the GDPH Comprehensive Cancer Registry (GCCR). GCCR is a population-based registry that collects, maintains, and analyzes cancer incidence data in Georgia. GCCR is responsible for determining how a cancer inquiry should proceed. After data collection and research into the inquiry, GCCR may
- Close the inquiry if a cluster is not identified.
- Request more information to conduct studies if a cluster is identified.
- Recommend education for residents, if necessary.
- Recommend a specific line of action to address identified environmental threats.

The GCCR routinely collects cancer data on all Georgia residents. Cancer data are submitted from different reporting facilities such as hospitals, independent laboratories, treatment facilities and physician offices. GCCR monitors data for completeness, quality and timeliness on a monthly basis. The national as well as Georgia standard is that reporting facilities are given 24 months to report all cancer cases diagnosed at their facility. Cancer data are released to the public when data meet the 95% completeness standard; that is, when 95% of all cancer diagnosed among Georgians for a calendar year are reported to the GCCR. At the time of this analysis was begun in 2009, the GCCR had data from 1995 through 2006.

Because of the lag time for cancer data submission and entry into the state database, we can not determine if more recent cases of cancer are being diagnosed in the area. However, there is no exposure pathway to carcinogenic compounds in any environmental media resulting from operations at Transco or other identified sources within the county.

Cancer Incidence Data for Madison County

GDPH received cancer incidence data analysis in fall 2009 for years 2002 - 2006 for Madison County and zip codes 30629 (Comer), and 30633 (Danielsville). These two zip codes cover approximately 140 square miles or half of Madison County, with a minimum five mile radius of Transco. Zip code areas are the smallest geographic units for which data are available. For these years, the overall age-adjusted cancer incidence rate in Madison County is significantly higher than the rate for the State of Georgia (Appendix G).
For zip code 30629 (Comer), the overall age-adjusted cancer incidence rate is 499.3 per 100,000 population. This is higher than the rate for Georgia (462.1 per 100,000), but this difference is not statistically significant.

For zip code 30633 (Danielsville), the overall age-adjusted cancer incidence rate is 451 per 100,000 population. This is lower than the rate for Georgia (462.1 per 100,000), but this difference is not statistically significant.

A review of cancer incidence data for zip code 30646 (Hull) shows significantly higher rates of cancer, unlike the other zip codes. For 30646, the overall age-adjusted cancer incidence rate is 619.4 per 100,000 population. This is significantly higher than the rate for Georgia (462.1 per 100,000).

- The overall age-adjusted cancer incidence rate for females is significantly higher than the rate for Georgia females.
- The age-adjusted lung cancer incidence rate is significantly higher for males than for Georgia males.

The elevated rates for females and for lung cancer in and near Hull, Georgia are not considered to be a result of operations at Transco. If you are concerned about cancer or would like information about cancer screening available in your area, please contact your health care provider. GDPH will continue to monitor cancer cases in Madison County. For detailed information about cancer, please contact GCCR at (404) 657-6315, or visit www.health.state.ga.us/programs/cancer.

Leukemia Data

To investigate the C.O.P.S. members’ report of newly diagnosed childhood leukemia cases, GDPH asked for contact information for families with a reported leukemia diagnosis, or to provide GDPH contact information to those families so we could verify the reports. GDPH did not receive contact information from C.O.P.S. members and no residents contacted GDPH with this requested information. Therefore, specific cases of recent leukemia diagnoses reported by C.O.P.S. members could not be verified.

The GCCR reports that for five years of data analyzed (2002 - 2006), the number of leukemia cases was 11 for Madison County for all age groups. There were three cases among children under age 18 and eight cases of adult leukemia. After mapping these recent data available for leukemia cases in Madison County, there is no indication of a cluster of leukemia cases in Madison County or near Transco (Figure 4). In addition, national statistics show that the number of leukemia cases in Madison County is similar to (males) and below (females) the U.S. rate and falling (National Cancer Institute, State cancer profiles; www.statecancerprofiles.cancer.gov).

Breast Cancer Data

To investigate the C.O.P.S. members’ report of elevated rates of breast cancer, GCCR reports that for the five years of data analyzed (2002 - 2006), there were 95 cases of breast cancer in
Madison County. The age-adjusted breast cancer incidence rate is higher for females in Madison County (128.3 per 100,000) than for Georgia females (118.5 per 100,000), but this difference is not statistically significant. In addition, national statistics show that the number of breast cancer cases in Madison County is similar to the U.S. rate and falling (Figure 5A).

In June 2010, GCCR plotted the 2003 – 2007 breast cancer cases for Madison County on a map (Figure 5B). The map shows that the cases diagnosed in 2003 – 2007 are distributed rather evenly throughout the county, and not clustered around Transco or any other petroleum pipeline or related facility. For questions about breast cancer data, please contact GCCR at (404) 657-6315, or visit www.health.state.ga.us/programs/cancer.

Cancer Cases Reported by C.O.P.S.

C.O.P.S. members provided GDPH a list and map of reported diagnosed cancer cases near the facility. Information provided for 54 people included first and last names, street name, approximate distance from Transco, and deaths.

Reviewing distance information from Transco, it appears that from Transco:

- 10 individuals reside approximately less than one mile
- 7 individuals reside approximately one mile
- 3 individuals reside approximately between one and two miles
- 8 individuals reside approximately two miles

Distances from Transco for the remaining 26 reported cases were not provided.

Vital Records Data

First, GDPH staff compared the information provided by C.O.P.S. members with Vital Records data to verify reported deaths. The state Vital Records (VR) Office maintains death records filed from 1919 to the present. VR data are completed in the county where the event occurred and require the skills and cooperation of many people and various professions. Death certificates are completed by funeral directors, certifying physicians and coroners, and are available to the public. The state VR repository does not provide electronic data for years prior to 1994.

Of the 54 cancer cases reported, 28 were listed as deceased. Of the names listed, only two names were found to match VR data, with one person documented as having died of cancer. No other exact name or close name matches were found. Many individuals on the C.O.P.S. list appeared to be related as they had the same last name (surname). Of the 54 people listed, 37 could be grouped into 12 surnames (at least two individuals sharing a surname). Of the 12 surnames, 7 contained 2 members, 1 had 3 members, 1 had 4 members, 2 had 5 members, and one had 6 members. Many of these individuals did share a street name along with a surname, but not all.

To investigate verifiable cancer-related deaths near Transco, VR provided a list of death records from 1994 - 2006 for Madison County by name and/or street name for the entire length of the...
three major streets near Transco. This data included all streets on the list and the map provided to GDPH by C.O.P.S. A total of 33 deaths were documented for individuals in these locations. For each death, the death certificate data includes the cause of death, sex, race, age at death, and last known home address.

**Cause of Death**

Death certificate data provides cause of death separated into four stages: immediate cause, cause B (direct cause of the immediate cause), cause C (direct cause of cause B), and underlying cause (direct cause of cause C). In other words, the ordering of the causes is as follows: underlying cause → Cause C → Cause B → Immediate cause. The immediate cause of death is further divided into five levels of increasing specificity. For example, immediate cause level 1 might be “neoplasm” while immediate cause level 5 might be “malignant melanoma of the skin”. All cause stages (immediate cause, cause B, cause C and underlying cause) and all five levels of the immediate cause were examined for each of the 33 deaths.

First, the immediate cause of death was used to divide the 33 total deaths into cancer deaths and noncancer deaths. Out of 33 total deaths, 10 had the immediate cause listed as some form of cancer. For each cancer death, the immediate cause level 1 was “neoplasm” and immediate cause level 2 was “malignant neoplasm”. Next, immediate cause levels 3-5 were used to determine the specific type of cancer for each. Of the 10 cancer deaths, one each was pancreatic cancer, stomach cancer and skin cancer, two each were breast cancer and lung cancer, and three were of other location. There were no more than two cancers of any one specific type.

About one-third of the noncancer deaths had an immediate cause of heart disease (seven out of 23). Two others had an immediate cause of cardiac arrest and heart attack, without indication of underlying heart disease. Other causes of death, based on a summary of the immediate cause, cause B, cause C, and underlying cause, included Parkinson’s disease, respiratory disease, urologic disease, renal disease, Alzheimer’s disease, cerebrovascular disease, transient ischemic attack, organ transplant rejection, and motor vehicle accident.

For noncancer deaths, cause B, cause C, and the underlying cause of death were examined in order to determine if any deaths that were not immediately caused by cancer had any underlying cancer indicated. The only deaths with underlying cancer were those that also had an immediate cause of cancer. This justifies the division of the 33 deaths into 10 cancer deaths and 23 noncancer deaths with no overlap between the two groups.

**Geographic Location**

Of the 22 out of 33 deaths with available addresses, 20 were along a 3.5 mile area of Highway 191. The other two were on Transco Road and Coile Road. All but 5 out of 10 cancer deaths for which an address is available were on Highway 191, within 2.5 miles of each other. Based on the available addresses, the cancer deaths do not appear to be associated geographically when compared to the distribution of all deaths (Figure 6).
Miscarriage Data

C.O.P.S. members requested that miscarriage rates be investigated. Miscarriage is the most common complication of early pregnancy. Miscarriage occurs in about 15-20% of all recognized pregnancies [American Pregnancy Association; www.americanpregnancy.org]. Many women, before realizing they are pregnant, may miscarry without knowing it—assuming their miscarriage is merely a heavier menstrual cycle. No significant difference exists between international rates and the rates in the United States. Miscarriages can occur for many reasons, not all of which can be identified. Genetic abnormalities within the embryo (i.e., chromosomal abnormalities) are the most common cause of miscarriage and account for 50-65% of all miscarriages [WebMD, LLC; http://emedicine.medscape.com/article/266317-overview].

Miscarriages are defined as greater than or equal to 20 weeks gestation, and included in VR. However, for many reasons, many miscarriages are considered private and not reported to a health care provider. To better analyze miscarriage rates, the data used is for all fetal deaths, as a percent of all births during the same time. Fetal death means “death prior to the complete expulsion or extraction from its mother of a product of human conception, irrespective of the duration of pregnancy” [Official Code of Georgia, TITLE 31 Chapter 10].

The GDPH Epidemiology Branch evaluated fetal death data for Madison County. Using 2000 Census tracks, the fetal deaths from 1994-2007 were less than five, except for 1998 which had nine. As a percent of all births, the rates range from 3.745% to 4.769%. For Madison County, this corresponds to less than 5 miscarriages for each year, except in 1998. In addition, 2006 had no reported fetal deaths for Madison County. It is interesting to note that the lowest percentage of fetal deaths in Madison County occurred in the census track where Transco is located (Figure 7).

AIR EMISSIONS

Natural gas pipeline pumping stations with natural gas fired engines or turbines in Georgia are required to obtain a construction permit from GEPD for new air polluting equipment, as well as an operating permit for emissions of pollutants into ambient (outdoor) air. Since about the year 2000, the operating permit must be a ‘Title V’ Air Quality Permit’ if the facility is a major source, as defined by Title V rules. Most pumping stations are major sources. The purpose of a Title V permit is to bring together all federal, state and local air pollution control requirements into a single, comprehensive ‘operating permit’ that covers all aspects of a facility’s year-to-year air emission activities [15]. The permitting process also allows residents easier access to information about a facility’s air pollution emitting equipment and any air pollution controls that are required.

According to the Title V permit application, Transco can emit as much as 6,000 tons of pollutants from its engine and turbine stacks into the air, annually. Since the emission sources are

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4 Title V of the 1990 amendments to the Clean Air Act introduced an operating permits program to ensure compliance with all requirements of the Clean Air Act and to enhance federal enforcement of the Act.
turbines and engines, and the fuel is natural gas, the pollutants emitted in the highest amounts are nitrogen oxides (NOx), carbon monoxide (CO), and volatile organic compounds (VOCs). Of the 6,000 tons, that includes 4,156 tons per year of NOx, 1,152 tons per year of CO, and 427 tons per year of VOCs (total = 5,735 tons). These figures reflect the highest potential emission levels for Transco. Other pollutants, such as particulate matter and sulfur dioxide, are emitted in much lower amounts. However, the actual emission amounts are significantly lower. This reflected in the annual emissions inventory reports submitted by Transco. For example, in 2004 Transco reported 2,634 tons of NOx, 677 tons of CO, and 224 tons of VOCs (total = 3,535 tons).

According to GEPD, fugitive (unintentional) emissions can leak from faulty pump seals, valves, flanges, compressors and turbines as well as during emergency shutdowns and maintenance. However, while emissions from such leaks include some VOCs, they mostly consist of methane.

In addition, the turbines and engines emit formaldehyde and trace amounts of benzene and other toxic pollutants. GEPD conducts air dispersion\(^5\) modeling for toxic air pollutants as part of the air permitting process for obtaining a construction permit. The GEPD Guideline for Ambient Impact Assessment of Toxic Air Pollutant Emissions\(^6\) provides a guide for estimating the environmental impact of a source of toxic air pollutants. A toxic air pollutant is defined as any substance which may have an adverse effect on public health, excluding any specific substance that is covered by a State or Federal ambient air quality standard. The guidelines are used in the review of all air quality applications for permits to construct or modify potential sources of air pollutants. In accordance, with the Guideline, computer models are used by GEPD to determine off-site concentrations for annual averaging periods and one-hour averaging periods (adjusting one-hour results to compare with 15-minute short-term limits).

The toxicity data available to GEPD includes limits published by the U.S. Occupational Safety and Health Administrations [www.osha.gov] and the American Conference of Governmental Industrial Hygienists [www.acgih.org] for use in work places. These limits have built-in safety factors; however, such factors are meant to only apply to workers in a work place. These workers are understood to 1) to be in adults in reasonably good health with an average ability to tolerate toxics, and 2) to have some choice over their being in that workplace. However the GEPD Guidelines were developed to also protect people living near an emissions source, including children and adults with pre-existing medical conditions that make them more sensitive to toxic exposures. And they are entitled to not be exposed to work-place levels of toxics. Therefore, the GEPD Guidelines specify the use of an additional safety factor for published limits.

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\(^5\) Dispersion modeling is a mathematical simulation of emissions as they are transported throughout the atmosphere. Dispersion models replicate atmospheric conditions (i.e., wind speed and direction, air temperature, mixing height). At a minimum, most of the models require meteorological data, emissions data, and details about the facilities in question, such as stack height, gas exit velocity, etc. For more information about air dispersion modeling, visit the U.S. Environmental Protections Agency at www.epa.gov/air/aqmportal/management/modeling/dispersion.htm.

In March 1993, Transco submitted an air quality application to GEPD to expand their operations by installing a Solar MARS® turbine [5]. NOx was the only pollutant for which the application indicated an increase above EPA published rules. Transco was required to conduct an impact analysis for NOx emissions from the new turbine. The Transco application, therefore, contained dispersion modeling to demonstrate that NOx emissions from the new turbine would not produce a significant impact off site. Results show that the potential maximum NOx impact was estimated to be less than one percent of the damaging level [5]. Additional information from the model is summarized below.

- Annual maximums would be most prevalent on the west side of the property (Transco Road).
- Maximums are higher near the source; the NOx concentration decreases the farther from the plant a receptor is.
- A secondary higher concentration would occur southeast and 1.86 miles downwind, at values less than half the maximum.
- Maximums of each model were very similar, within six percent for all years analyzed.

In August 1993, GEPD determined that the Transco MARS turbine proposal would not result in a permit violation [16].

The GEPD operating permit inspection report, dated September 2004, states the plant was in compliance with the Georgia Rules for Air Quality Control and its permit. Another turbine was permitted about 1980. The permit limits NOx emissions from it to 20 pounds/hour. A compliance test conducted by GEPD during the time of the inspection indicated that NOx was 17.3 pounds/hour. Therefore, no violations were recorded.

Some members of C.O.P.S. have expressed concerns about fugitive emissions from the Transco facility, following a recent report from the Texas Commission on Environmental Quality. Air testing over one of the nation's largest natural gas fields, the 5,000-square-mile Barnett Shale in Texas, showed elevated levels of several air contaminants. However, there are no natural gas fields in Georgia; therefore, no exposures to emissions from this source exist at Transco. Additionally, Texas residents have complained about noise from local natural gas compressor stations, but no complaints of noise have been received from residents near the Transco facility. However, it is noted that numerous gas compressor stations like the Transco facility are located in both rural and residential areas near the Barnett Shale. Therefore, GDPH will continue to monitor reports about potential health effects from exposure to air emissions from natural gas compressor stations. To date, no conclusive evidence of health effects from ambient air exposures have been documented.

**Formaldehyde**

Members of C.O.P.S. requested air dispersion modeling for formaldehyde emissions from Transco. Formaldehyde is a colorless gas with a pungent, irritating odor, soluble in water, and 1.3 times heavier than air. The major sources of man-made emissions of formaldehyde are motor vehicle exhaust, power plants, manufacturing plants that produce or use formaldehyde or substances that contain it (i.e., glues), petroleum refineries, coking operations, incinerating, wood
burning and tobacco smoke. Human exposure to formaldehyde is usually from breathing in contaminated indoor air. According to EPA and the International Agency for Research on Cancer, formaldehyde is a probable human carcinogen.

Formaldehyde is released to the air from both natural and industrial sources. Combustion processes account directly and indirectly for most of the formaldehyde entering the atmosphere. Naturally occurring formaldehyde also arises from atmospheric oxidation of naturally occurring alkenes. After being emitted into air, it degrades rapidly and is removed from the atmosphere by direct photolysis (from sunlight), photochemical processes, precipitation and biodegradation. Because formaldehyde is a volatile gas, it breaks down easily and quickly in air. Its “half life” (the time required for one half the atoms of a given amount of a substance to disintegrate) is very short. Depending on atmospheric conditions, half of the formaldehyde in air will be gone within a range of 6 to 19 hours. [17].

EPA released the report, *Toxicological Review of Formaldehyde-Inhalation Assessment* in the June 2, 2010 Federal Register [www.gpo.gov/fdsys/pkg/FR-2010-06-02/html/2010-13097.htm]. This assessment will help EPA and others to determine the level of risk formaldehyde poses to Americans’ health. EPA undertook this assessment because there have been a number of potentially significant new studies published since EPA’s last review of formaldehyde toxicity. However, there are limited data provided in the report revealing a relationship between adverse health effects and exposure to formaldehyde and ambient air.

For more information about formaldehyde in outdoor air, see Appendix H.

**Air Dispersion Modeling Results**

To address community concerns about the levels of formaldehyde released to ambient (outdoor) air from the Transco facility, GDPH requested ATSDR’s assistance with evaluating formaldehyde emissions from that facility. ATSDR conducted a site visit February 18, 2010, reviewed information provided by the facility, and applied the site-specific parameters in an air dispersion model to estimate formaldehyde levels in the community [18].

ATSDR used the measured data points, estimated emissions levels, and area-specific meteorological data in a computer model to help predict the formaldehyde concentrations that might be present over various durations of time in the air in residential areas near Transco. ATSDR then compared the predicted modeled values with various health and regulatory values to help determine if harmful health effects are indicated at those predicted values.

Based on the results, GDPH concludes that exposure to the predicted formaldehyde levels in air for the closest residential areas to Transco are not expected to cause harmful health effects.

The highest predicted concentrations of formaldehyde in air in residential areas are 1-hour averages, and range between 350 and 399 micrograms per cubic meter (µg/m³). This is below the irritation level of 612 µg/m³ and EPA’s Acute Exposure Guideline Level of 1,100 µg/m³. The highest predicted 24-hour formaldehyde levels in air in the residential areas are between 56 and
70 µg/m³. This is above ATSDR's acute minimal risk level (MRL) of 50 µg/m³. However, the 24-hour averages (including adding an estimated background concentration of 1.5 µg/m³) only exceeded the acute MRL at the closest residential area for five days over a 5-year period [18].

ATSDR uses the no observed adverse effect level/uncertainty factor (NOAEL/UF) approach to derive MRLs for hazardous substances. They are set below levels that, based on current epidemiologic data and other information, might cause adverse health effects in the people most sensitive to such substance-induced effects. An acute MRL is based on exposure of more than 24 hours and up to two weeks. Chronic MRLs are based on exposures 365 days or longer.

Because a general review of available information and predictive models includes a level of uncertainty, this information cannot be used to determine the health impacts of a specific individual particularly those with pre-existing respiratory disease or immune compromised systems. Those individuals should consult with their health care provider about their health concerns. Also, we only considered formaldehyde and not other chemicals released from the facility, nor other chemicals that people may be exposed to in their homes, at work, or in other locations.

The predicted residential chronic exposure levels including background are within the EPA acceptable risk range. Based on these results, GDPH concurs with ATSDR’s recommendation to re-evaluate the formaldehyde emissions from this facility if:

1) Additional stack testing is done at this facility.
2) Engines are added, replaced, or modified or usage changes that would increase emissions substantially.

PATHWAY ANALYSIS

GDPH identifies pathways of human exposure by identifying environmental and human components that might lead to contact with contaminants in environmental media (for example; air, soil, groundwater). A pathways analysis considers five principle elements: a source of contamination, transport through an environmental medium, a point of exposure, a route of human exposure, and a receptor population. Completed exposure pathways are those in which all five elements are present, and indicate that exposure to a contaminant has occurred in the past, is presently occurring, or will occur in the future. GDPH regards people who come into contact with contamination as exposed. 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. Potential exposure pathways are those for which exposure seems possible, but one or more of the elements is not clearly defined. Potential pathways indicate that exposure to a contaminant could have occurred in the past, could be occurring now, or could occur in the future. However, key information regarding a potential pathway may not be available. It should be noted that the identification of an exposure pathway does not imply that health effects will occur. Exposures may, or may not be substantive. Thus, even if exposure has occurred, human health effects may not necessarily result (18).
For Transco, GDPH reviewed the site’s history, community concerns, and available environmental sampling and health outcome data. Based on this review, GDPH did not identify an exposure pathway that warranted consideration.

The pathways analyses and toxicological evaluation processes used in a public health assessment are described in more detail in Appendix I.

CHILD HEALTH CONSIDERATIONS

To protect the health of the nation’s children, ATSDR has implemented an initiative to protect children from exposure to hazardous substances. In communities faced with contamination of the water, soil, air, or food, ATSDR and GDPH recognize that the unique vulnerabilities of infants and children demand special emphasis. Due to their immature and developing organs, infants and children are usually more susceptible to toxic substances than are adults. Children are more likely to be exposed because they play outdoors and they often bring food into contaminated areas. They are also more likely to encounter dust, soil, and contaminated vapors close to the ground. Children are generally smaller than adults, which results in higher doses of chemical exposure because of their lower body weights relative to adults. In addition, the developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages.

CONCLUSIONS

GDPH concludes that exposure to contaminants present at this site are not expected to harm people’s health because the public has not been, are not currently, and are unlikely to be exposed to on-site contamination. Specifically,

1. Soil contamination has been contained on-site in restricted access areas, and to undeveloped woodland of Transco property not easily accessible and rarely accessed by the general public.
2. Sediment contamination is limited to on-site drainage ways and a creek on Transco property in areas not used for recreation.
3. There is no off-site groundwater contamination from facility operations.
4. The facility has consistently remained in compliance with air emissions regulations.
5. Formaldehyde emissions from this facility are not at levels that pose a health hazard to nearby residents.

RECOMMENDATIONS

No additional public health actions are recommended at this time. If additional data become available, the information will be reviewed by GDPH, and appropriate actions will be taken. GDPH will continue to respond to requests for information and health and environmental concerns about operations at Transco.

For more information about the community health assessment projects described, epidemiology services, health outcome data, and other activities conducted for the Transco site and Madison
County by the NEHD, please contact Dr. Louis Kudon, Northeast Health District, at (706) 583-2869.

For information about cancer, please contact GCCR at (404) 657-6315, or visit www.health.state.ga.us/programs/cancer.

Questions and concerns about the environmental data evaluated in this report should contact Jane Perry, GDPH, Chemical Hazards Program, (404) 657-6534.
REFERENCES


5. Transcontinental Gas Pipeline Corporation, *Application for permit to expand operations of a natural gas-fired turbine unit (prime mover) at Transcontinental Gas Pipe Line Corporation’s Station 130, Madison County, Georgia*. March 1993.


16. Georgia Environmental Protection Division, Prevention of significant air quality deterioration review of the Transcontinental Gas Pipe Line Corporation Natural Gas Compressor Station No. 130 located near Comer, Georgia (Madison County), Preliminary Determination. August 1993.


18. Agency for Toxic Substance and Disease Registry, *Health Consultation: Transcontinental Gas Pipeline, Compressor Station #130 in Comer, Georgia; April, 2011*.

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FIGURES
FIGURE 1: SITE MAP AND DEMOGRAPHIC CHARACTERISTICS

Base Map Source: Geographic Data Technology. May 2006.
Site Boundary Data Source: ATSDR Geospatial Research, Analysis, and Services Program,
Current as of Generable Data (foot left-hand corner).
Coordinate System (All Panels); NAD 1983 StatePlane Georgia East FIPS 1001 Foot

Legend
- Hazardous Waste Site of Interest
- Other Hazardous Waste Site
- Two Mile Buffer

0 0.6 1.2 1.8 Miles

Demographic Statistics
Within Two Mile of Site*

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
</tr>
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<tbody>
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<td>White Alone</td>
<td>624</td>
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<tr>
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<td>8</td>
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<tr>
<td>Am. Indian &amp; Alaska Native Alone</td>
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</tr>
<tr>
<td>Asian Alone</td>
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<td>Native Hawaiian</td>
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<td>Children Aged 6 and Younger</td>
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<td>88</td>
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<tr>
<td>Females Aged 15 to 44</td>
<td>136</td>
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<tr>
<td>Total Housing Units</td>
<td>265</td>
</tr>
</tbody>
</table>

Demographics Statistics Source: 2000 U.S. Census
* Calculated using an area-proportion spatial analysis technique
** People who identify their origin as Hispanic or Latino may be of any race.

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FIGURE 2: TRANSCO FACILITY AND SURROUNDING AREAS

O--Approximate one-half mile radius

(Source: © 2010 Google–Map data. All rights reserved.)
FIGURE 3: TOPOGRAPHIC SITE MAP
FIGURE 4: LEUKEMIA INCIDENCE DATA

Verified Leukemia Cases, 1999-2007
Madison County, Georgia

Legend
- Leukemia Case
- Other
- Population Density

Leukemia Cases, Madison County 1999-2007

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<thead>
<tr>
<th>Zip Code</th>
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<td>3</td>
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<tr>
<td>30629</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

Children <18 years, 3 cases
Adults >18 years, 15 cases

Data Sources: Georgia Division of Public Health, Georgia Comprehensive Cancer Registry and Health Planning and Assessment Unit July 31 10
FIGURE 5A: BREAST CANCER RATES FOR MADISON COUNTY

Death Rate/Trend Comparison by Cancer, death years through 2006
Georgia Counties versus United States
(Source: National Cancer Institute, State cancer profiles; www.statecancerprofiles.cancer.gov)

Breast, All Races, Female

<table>
<thead>
<tr>
<th>Above US Rate</th>
<th>Similar to US Rate</th>
<th>Below US Rate</th>
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<tr>
<td>Priority 1: rising ↑ and above ↑</td>
<td>Priority 5: falling ↓ and below ↓</td>
<td>Priority 3: rising ↑ and below ↓ [none]</td>
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<tr>
<td>Priority 4: stable → and above ↑</td>
<td>Priority 6: stable → and similar =</td>
<td>Priority 7: stable → and below ↓</td>
</tr>
<tr>
<td>Muscogee County</td>
<td>Bibb County</td>
<td>Clarke County</td>
</tr>
</tbody>
</table>

Stable Trend

| Priority 5: falling ↓ and above ↓ | Priority 1: rising ↑ and similar = | Priority 9: falling ↓ and below ↓ |
| Fulton County | Bibb County | Georgia |
| | Barrow County | Gwinnett County |
| | Chatham County | Hall County |
| | Cobb County | |
| | Coweta County | |
| | Fayette County | |
| | Houston County | |
| | Madison County | |
| | Richmond County | |

Falling Trend

Trend:
- **Rising** ↑ when 95% confidence interval of average annual percent change is above 0.
- **Stable** → when 95% confidence interval of average annual percent change includes 0.
- **Falling** ↓ when 95% confidence interval of average annual percent change is below 0.

Rate Comparison:
- **Above** ↑ when 95% confident the rate is above and Rate Ratio$^3$ > 1.10
- **Similar** = when unable to conclude above or below with confidence.
- **Below** ↓ when 95% confident the rate is below and Rate Ratio$^3$ < 0.90
Priority indices were created by ordering from rates that are rising and above the comparison rate to rates that are falling and below the comparison rate.

Recent trend in death rates is Average Annual Percent Change (AAPC) based on the APCs calculated by Joinpoint Regression Program. Due to data availability issues, the time period used in the calculation of the Joinpoint model may differ for selected racial groups or counties.

Rate ratio is the county rate divided by the US rate.

Source: Death data provided by the National Vital Statistics System public use data file. Death rates calculated by the National Cancer Institute using SEER*Stat. Death rates are age-adjusted to the 2000 US standard population (19 age groups: <1, 1–4, 5–9, … , 80–84, 85+). Population counts for denominators are based on Census populations as modified by NCI.

Note: When the population size for a denominator is small, the rates may be unstable. A rate is unstable when a small change in the numerator (e.g., only one or two additional cases) has a dramatic effect on the calculated rate. Suppression is used to avoid misinterpretation when rates are unstable.

State Cancer Registries may provide more current or more local data. Data presented on the State Cancer Profiles Web Site may differ from statistics reported by the State Cancer Registries (for more information).
FIGURE 5B: BREAST CANCER INCIDENCE DATA

VERIFIED BREAST CANCER CASES
(Source: Georgia Comprehensive Cancer Registry, Georgia Department of Community Health, Division of Public Health, 2009)

Madison County, Georgia
2003 – 2007

- Breast cancer case
- Zip code boundary
- Madison County boundary
FIGURE 6: MISCARRIAGE DATA FOR MADISON COUNTY

Madison County Fetal Deaths by Census Tracts, 1994 - 2007

Fetal death as a % of all births

- 3.745%
- 3.746% - 3.753%
- 3.754% - 3.759%
- 3.76% - 4.412%
- 4.413% - 4.769%
FIGURE 7: CANCER MORTALITY DATA FOR MADISON COUNTY

Cancer Mortality, 1994-2006

Legend for All Maps

- Transco
- 3 mile Buffer

Madison County, Georgia

Cancer and Noncancer Mortality
- Green: Cancer Mortality
- Light green: Noncancer Mortality with related cancer
- Light blue: Noncancer Mortality with unrelated cancer

U.S. Leading Cause of Death -- Noncancer
- Green: No
- Purple: Yes

Cancer Mortality - Common Type
- Brown: No
- Blue: Yes

Cancer Mortality - Types
- Yellow: Bone and Cartilage
- Pink: Breast
- Orange: Pancreatic Cancer
- Green: Head-Face-Neck
- Blue: Skin
- Red: Stomach
- Gray: Other

Data Source: Georgia Division of Public Health
Office of Vital Records
jhmc:5,10,10
APPENDIX A: OTHER MADISON COUNTY PIPELINE FACILITIES

Note: This section is not about the Transcontinental Gas Pipeline Company facility in Madison County, Georgia. Other petroleum pipelines in Madison County are related only by proximity, and not by purpose, product or health concerns.

Georgia produces no crude oil, has no oil wells in operation and has no proven reserves of crude oil. Therefore, we must rely on imports of refined petroleum products to meet demand. Most of the petroleum imports come into Georgia via two interstate pipelines – the Colonial and the Plantation pipelines.

In October, 2007 the Madison County Commission sent a letter to GEPD regarding excavation activities at Colonial and Plantation pipelines. The Commissioners requested that GEPD provide “notice of the time, place, and reason for any pipeline excavations within the county” and, “whenever excavations occur, county officials (perhaps the Health Department or Extension Agent) be permitted to take soil and water samples from the site for testing.” (Appendix A-1). While there are no regulations requiring advance permitting or notification regarding this work, in April, 2009 Transco notified GEPD about a physical pipeline inspection scheduled for Madison County in July. To date, no excavations or sampling has occurred.

For spatial and geographic reference, Appendix A-2 is a map submitted to GDPH by C.O.P.S. showing the number of land parcels in Madison County (approximately 3,600) within a half mile of the three pipelines, and associated facilities.

Colonial Pipeline Company

Atlanta-based Colonial Pipeline Company operates two liquid petroleum pipelines that pass through Madison County near Danielsville. Colonial is the largest-volume pipeline transporter of refined petroleum products in the world. Colonial operates interstate pipelines transporting refined liquid petroleum products from Texas and Louisiana to locations throughout the southeastern and eastern United States. Colonial Pipeline Company transports almost 70% of all gasoline and fuel sold in Georgia (5).

Constructed in 1963, the Danielsville Booster Station (DBS) in Madison County consists of four large compressor pumps with associated valves and controls. Other structures on the DBS property are a control building, a 625-barrel utility tank, an oil-water separator, a retention pond, a septic tank system, and a water supply well. A 36-inch pipeline was also constructed in 1963 and used to transport diesel fuel, kerosene, other fuel oils, and gasoline from 1963 until 1979. A 40-inch pipeline was added in 1979 and is used to transport gasoline. Currently, the DBS only serves the 36-inch pipeline for transporting diesel fuel, kerosene, and other fuel oils.

The DBS is located approximately two miles southwest of Danielsville. The site is located on a hilltop and is surrounded by gently rolling hills covered with hardwood and pine forests and open fields. The site is fenced and there is no public access. The closest residence is within 0.5 miles of the booster station complex.
In December 1994, petroleum odors were noticed in the DBS water supply well. Colonial sampled the well and benzene was found above regulatory levels. Through 2001, approximately 30 residential wells were tested repeatedly for petroleum contamination. Seven well sample results were positive for petroleum constituents. Upon detection of petroleum constituents in each well, Colonial provided bottled drinking water, installed whole house water treatment systems, and subsequently purchased properties where contamination was found. In addition, Colonial purchased another 20 properties surrounding the site in an effort to maximize monitoring and remediation of the contaminated groundwater plume, and to prevent human exposure to petroleum contamination. [19].

Surface water and soil samples have been collected periodically from 1995 to 2005 and collected from 21 nearby surface water locations. There are no significant impacts to surface water. Ongoing investigations are being conducted at the DBS site and in the surrounding community since 1995 to characterize the extent of contamination released to environmental media (soil, groundwater, and surface water). The DBS currently operates under a GEPD approved Corrective Action Plan that includes semi-annual monitoring of the bedrock (deep) and saprolite (shallow) aquifer plumes, remediation actions, and monitoring of the effectiveness of remediation actions. Petroleum contamination of groundwater from the DBS has remained relatively constant from 1995 to 2009, but the levels are decreasing in some of the saprolite monitoring wells on the facility property.

Public Health Assessment

Residents living near the DBS have expressed concern about petroleum contamination of groundwater underlying the booster station and surrounding area. In response, GDPH published a public health assessment for the site in June, 2006. In addition, municipal water has been available in the area since 2005, and residents were advised to hook up to the municipal water source for their household water use.

In 2006, EPA levied the largest fine in the agency’s history against Colonial Pipeline Company resolving charges that the company violated the Clean Water Act on seven occasions by spilling 1.45 million gallons of oil from its 5,500 mile pipeline in five states: Georgia, Tennessee, Louisiana, South Carolina, and North Carolina. Colonial settled a $34 million fine and set aside another $30 million for increased inspection, maintenance and monitoring along its pipeline system. Note: the spill in Georgia included in this penalty occurred in another area of the state and not from the Colonial Pipeline facility in Madison County.

Based on the data evaluated, GDPH considers this site to pose no apparent past or current public health hazard. Specifically:

1. Exposure to benzene above health based comparison values is known to have occurred at six residences in the past, all of whom had drilled, bedrock wells on their properties. For the purposes of this public health assessment, the maximum concentration of benzene measured at each of these properties was used as a conservative measure for estimating
the highest exposure doses one could have received. Children and adults exposed to the maximum concentration of benzene from any of these six residences are not likely to be at any increased risk for non-cancer health effects. The actual concentrations of benzene that residents were exposed to are likely to be less than the maximum concentrations found. The longest exposure duration at this site could have been six months. However, based on sampling frequencies, and immediate mitigation of residential contamination, the actual exposure period is likely to have been less than the exposure period used in this public health assessment to calculate exposure doses.

2. The pathway and migration of petroleum contamination that lead to human exposure has been confined to the deep, bedrock aquifer underlying the DBS site and the surrounding area. Shallow, saprolite groundwater contamination has remained confined to an area underlying the DBS yard and has been a source of bedrock groundwater recharge. Shallow aquifer contamination has never migrated off-site to residential property near the DBS. Of the approximately 180 residential wells within a one-mile radius of the DBS, 133 (74%) are shallow (water-table wells), bored or dug wells in the saprolite. Residents having shallow, bored wells in the Colbert Grove Church Road community have never been exposed to site-related contaminants.

3. Residents exposed to benzene at the maximum level found have low to very low risks for developing cancer from exposure to these concentrations over the periods that they may have been exposed.

As of March 30, 2010, Colonial paid for the county to connect 54 residents to the municipal water supply. Thirteen residents declined to connect to municipal water, and one resident has since disconnected from the municipal water supply.

New Data Review

GDPH reviewed recent data and information, and community concerns, for the Colonial facility. Two bedrock (deep aquifer) monitoring wells were installed in December 2005. However, data from these wells were not available at the time the PHA was published. Both of these wells are on private property located southeast of the DBS property. Benzene was found exceeding health values in one of the wells on several occasions. As described above and in the public health assessment, there is no exposure to contaminants in the shallow water aquifer. A small amount of missing data from the company’s previous deep water aquifer sampling event in the mid-1990s is irrelevant for evaluating the potential for human exposure. No other data or information available indicates that human exposure to contaminated groundwater has occurred or is occurring. Therefore, GDPH concludes there is no evidence that additions or changes to the original public health assessment conclusions are warranted.

Vapor Intrusion Modeling

In response to a request from C.O.P.S. members, GDPH conducted vapor intrusion modeling for homes closest to the DBS property. Some C.O.P.S. members expressed concerns about exposure
to the underground contaminated groundwater plume and reported (not verified) cancer cases
diagnosed in families living near the DBS.

Vapor intrusion is a term used to describe the process in which chemical vapors from
contaminated soil or groundwater affect the indoor air quality in a building. When chemicals are
spilled or leak, they can soak into the soil or dissolve into the groundwater and spread. The
contaminated soil or groundwater can emit vapors that spread to areas occupied by buildings.
Vapors can enter the buildings through cracks in basements, foundations, sewer lines, and any
other type of opening. Occasionally, the vapors can increase to concentrations that may be
harmful to human health.

There are two basic criteria for determining if it is necessary to evaluate vapor intrusion at a
hazardous waste site. First, volatile (evaporating rapidly; passing off readily in the form of
vapor) contaminants must be present in the subsurface soil; and second, buildings must be
laterally and vertically close enough to the subsurface contaminants for concentrations above
health concern to reach indoor breathing zones [1].

Preliminary screening is useful in establishing potential vapor intrusion impact areas around
releases. Often, significant contaminant concentrations are found in relatively close proximity to
the original source. EPA guidance establishes an area within 100 feet vertically or laterally from
a volatile concentration of regulated chemical as a potential impact area. Some states have
established buffers of 30 feet. Other states, such as New Jersey, established different distance
criteria based on the contaminant type (petroleum versus chlorinated hydrocarbons). Recent
studies suggest that even for sites with the presence of pure petroleum product (like the Colonial
pipeline site) and contamination six feet below the surface, volatile emissions will tend to be
insignificant at lateral distances of 100 feet transgradient to groundwater flow from a source [1].

The benzene plume in the shallow water aquifer is confined, and the benzene concentrations and
plume size have remained relatively constant from 1995 to 2009. There is an apparent trend of
decreasing benzene concentrations at some of the on-site monitoring wells [2]. Furthermore, the
nearest residence with a house built on the ground (concrete slab verses trailer) is approximately
500 feet from the closest edge of the benzene plume. Therefore, GDPH concludes that nearby
residential exposure to benzene from the vapor intrusion pathway is highly unlikely.

The Colonial site meets only one of the two basic criteria needed for determining if vapor
intrusion may be a potential exposure pathway of concern: volatile contaminants are present in
the subsurface. Because of health concerns expressed by C.O.P.S. members, GDPH ran a model
for a hypothetical, worst case scenario for a house built above the plume. Based on known
parameters regarding the benzene plume, GDPH applied the EPA spreadsheet version of the
Johnson and Ettinger (J&E) model (www.epa.gov/athens/learn2model/part-
two/onsite/JnE_lite_forward.html) to estimate benzene concentrations of indoor air assuming a
slab-on-grade home were built directly over the plume over MW-12, the monitoring well placed
in the area with the highest five year average benzene level, and closest to a residential property.
A five-year average benzene concentration of 27.24 ug/L in MW-12 [3], 43 feet ±10 feet
monitoring well depth [4], and an average soil (sandy loam) temperature of 66.3 degrees
Fahrenheit were used as parameters in the J&E model calculations of predicted indoor air concentrations in this hypothetical home.

Predicted results ranged from a low indoor air concentration of 0.3925 micrograms per cubic meter (ug/m³) to a high indoor air concentration of 0.7893 ug/m³. The low prediction concentration assumes a high moisture concentration in the soil and the deepest depth to contamination. The high prediction concentration assumes a low moisture concentration in the soil and the shallowest depth to contamination. The best estimate for predicted indoor air concentration is 0.6395 ug/m³, which is based on the best estimate of depth to the sample location and residual moisture content for a sandy-loam soil. The best estimate is approximately 16 times below the lowest ATSDR health value (Minimal Risk Level) of 10 ug/m³.

Therefore, no residents near the Colonial facility are being exposed to harmful vapors from contaminated groundwater. GDPH requested contact information from C.O.P.S. for families they report have recent leukemia diagnoses, but none was provided. GDPH evaluated childhood leukemia cases through 2007 near Colonial and no elevated number of cases was found (Figure 4). Because of the lag time for cancer data submission and entry into the state database, we can not determine if more recent cases of leukemia are being diagnosed in children in the area. However, there is no exposure pathway to carcinogenic compounds in groundwater contaminated by operations at Colonial. GDPH will continue to monitor cancer cases in Madison County.

References


Additional information regarding Colonial Pipeline is included in the 2006 Colonial Pipeline Company public health assessment. GDPH will continue to respond to health-related concerns from the public. GDPH will review additional data as it becomes available and provide documents, including a follow-up health consultation, if appropriate. No additional public health actions are recommended at this time.

Plantation Pipe Line Company

Alpharetta, Georgia-based Plantation Pipe Line Company is operated and majority owned by the Kinder Morgan Energy Partners. Since 1942, Plantation operates an interstate liquid petroleum pipeline that transports more than 20 million gallons of gasoline, jet fuel, kerosene and heating oils from Louisiana throughout the southeastern United States each day.

Plantation’s active Center Pumping Station is located on Georgia Highway 106 in Hull, approximately ten miles northeast of Athens, Georgia. The area surrounding the site is rural and includes forested areas to the north, a mobile home park to the east, and residential dwellings and pastures to the south and west. The regional topography is gently sloping with a well-defined dendritic drainage pattern.

In February, 2003 approximately 33,000 gallons of gasoline spilled from the site. The gasoline spilled from a block valve flange gasket located on a 26-inch pipeline on the northern side of an unmanned pump station. Some of the gasoline entered an unnamed tributary of East Sandy Creek, which empties into the North Oconee River. According to Kinder Morgan, Plantation’s parent company, no residential drinking water was contaminated and groundwater flow was away from residential areas [Madison Journal Today, Plantation fined for ’03 petroleum spill in county, 11/16/11].

Plantation repaired the flange and initial abatement activities including:

- containment of released gasoline
- excavation and repair of the pipeline
- soil sampling
- groundwater sampling
- water supply well sampling
- surface water monitoring
- installation of interceptor trenches with a total fluids recovery system

Results of operating the remediation systems combined with gauging and groundwater monitoring events from January 2008 to January 2009 estimated the extent of benzene to show long-term trends of reduced dissolved phase benzene. The reduced magnitude and extent of dissolved phase benzene is attributed to operation of the remediation systems.

Private water supply wells located within one-half mile of the site were sampled and on two occasions, contaminants were detected and residents were notified. Follow up sampling did not detect contaminants in any wells. Surface water samples were also collected and analyzed and the company reports that the contamination has been contained to non-recreational waters.

In 2008, Plantation settled with the U.S. Justice Department and EPA for violating the Clean Water Act and for discharges of jet fuel and gasoline in Virginia, Georgia, and North Carolina. The civil penalty was for $725,000 and also included $1.3 million for implementing new spill prevention safeguards.
Plantation intends to continue operation of the Center Pumping Station site remediation systems. In 2009, the groundwater sampling program continued on a semi-annual frequency with monitoring events taking place in April and October. The groundwater monitoring program included sample collection from the new monitoring wells installed in November of 2008. The *Fourth Annual Remedial Effectiveness Report* covering the period from January 2009 to January 2010 was submitted to GEPD 2010.

GDPH published, *Public Health Assessment: Plantation Pipe Line Company, Center Pumping Station Block Valve Release Site* in March, 2011. GDPH concluded that the 2003 spill did not, is not, and will not harm the health of residents living near the site. In summary:

1. Residents living near the site were not exposed to gasoline-contaminated soil from the block valve release site because contaminated soil was limited to on site.
2. Off-site private well monitoring showed that all residential wells used for drinking water within ½ mile of the Plantation site have never been impacted by site-related contaminants.
3. For the levels of contaminants found in on- and off-site (accessible from private property) surface water, GDPH calculated both a worse case scenario as well as a more realistic approach to exposure evaluation to determine if adverse health effects were likely. From these analyses, significant non-cancer adverse health effects are not likely to occur from exposure to surface water.
4. The vertical and horizontal extent of groundwater contamination is well-defined and determined to be localized to Plantation property. Moreover, remediation efforts have shown the contamination plume is shrinking with time. Exposure to on-site contaminated groundwater has never occurred.
5. Except for one event that occurred in January 2004, water treatment system effluent discharge into the on-/off-site stream has continuously been in compliance with GEPD surface water discharge requirements since July 2003.
6. Plantation is located in a sparsely populated rural area. Site air emission rates are significantly lower than GEPD emission limits outside the Atlanta metro non-attainment area. With populated areas being ¼ mile or greater from the site, adverse health effects from facility emissions are not expected.

All private wells within one-quarter and one-half mile of the Plantation site will continue to be monitored on a semi-annual and annual basis, respectively, until the site has been remediated to requirements set by GEPD. In addition, on-site remediation will continue under GEPD oversight. There are no public health recommendations at this time. GDPH will respond to health-related concerns from the public regarding the Plantation pipeline spill in Hull.

APPENDIX A-1: LETTER FROM BOARD OF COMMISSIONERS TO GE PD

H│B│S│S HALL BOOTH SMITH & SLOVER, P.C.

Michael C. Pruett  440 College Avenue North, Suite 120
P: (706) 316-0231  Athens, GA 30601-2773
E: mcp@hbss.net  P: (706) 316-0231  F: (706) 316-0253  W: www.hbss.net

October 2, 2007

Georgia Department of Natural Resources
Attn: Director Dr. Carol Couch
Environmental Protection Division
2 Martin Luther King Jr. Drive
Suite 1152, East Tower
Atlanta, GA 30334

RE: Request for Notification of Petroleum Pipeline Excavation Activity

Dear Dr. Couch:

My client, the Board of Commissioners of Madison County, Georgia, has asked me to submit this request, and we hope that it can be accommodated.

Madison County is traversed by two petroleum pipelines, owned by Colonial Pipeline Company and Plantation Pipe Line Company. It appears that numerous citizens have been alarmed by the sight of excavation activities at pipeline sites, and called their representatives on the Board of Commissioners for information. These excavation activities were, as I understand it, related to EPD-supervised testing and were not cause for alarm. Unfortunately, the commissioners had no notice and thus could not inform or reassure their constituents.

Therefore, this is to request that the Board of Commissioners be provided notice of the time, place, and reason for any pipeline excavations within the county. For ease of communication, such notice may be directed to County Clerk Morris Fortson, P. O. Box 147, Danielsville, Georgia 30633, phone (706) 795-6302, fax (706) 795-2997, email crfl@madisonco.us. Mr. Fortson will then distribute the information to the commissioners.

Additionally, if possible, the Board requests that whenever excavations occur, county officials (perhaps the Health Department or Extension Agent) be permitted to take soil and water samples from the site for testing.

Your consideration of this request is much appreciated. Please do not hesitate to contact me for further information, if needed.

With kindest regards, I am

Very truly yours,

Michael C. Pruett

MCP/jp

C: Madison County Board of Commissioners
   Morris Fortson, County Clerk
APPENDIX A-2: PIPELINES WITH PARCELS WITHIN ONE-HALF MILE
## APPENDIX B: CHRONOLOGY OF ASSESSMENT AND REMEDIAL ACTIVITIES
(Source: Transcontinental Gas Pipeline Company, April 9, 2010)

<table>
<thead>
<tr>
<th>Date</th>
<th>Activity</th>
<th>Number of Samples Collected</th>
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<tr>
<td></td>
<td></td>
<td>Soil</td>
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<tr>
<td>Jan-89</td>
<td>Phase I PCB Assessment (air system, drainlines, drainage ways, former pits)</td>
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<tr>
<td>May-89</td>
<td>On-Site Drinking Water Well Sampling (3 wells)</td>
<td>3</td>
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<tr>
<td>Dec-89</td>
<td>An Assessment of the Potential Influence of Residual PCB Concentrations on Drinking Water Supplies in the Vicinity of Transcontinental Gas Pipe Line Corporation Station 130</td>
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<tr>
<td>Jan-90</td>
<td>Phase II PCB Assessment (air system, drainage ways, areas west of Hwy. 121, former pits)</td>
<td>223</td>
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<tr>
<td>Mar-90</td>
<td>Phase II B PCB Assessment (air system, drainage ways, areas west of Hwy. 121)</td>
<td>329</td>
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<td>Apr-90</td>
<td>Auxiliary Building Air Compressor Wipe Sampling (PCBs)</td>
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<tr>
<td>Jul-90</td>
<td>Phase I C PCB Assessment (air system, drainlines)</td>
<td>36</td>
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<tr>
<td>Dec-90</td>
<td>Water Management System (WMS) Evaluation (station-wide soil and water, PCBs, TPH, metals)</td>
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<td>Apr-91</td>
<td>Off-Site Drinking Water Well Sampling (7 wells, split with GADNR)</td>
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<td>Jun-91</td>
<td>Air System Decontamination (PCBs)</td>
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<td>Jul-92</td>
<td>Public Health Risk Assessment and Fate and Transport Assessment, Transcontinental Gas Pipe Line Corporation Station 130, Comer, Georgia (Groundwater Technology, July 1992)</td>
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<tr>
<td>Jun-93</td>
<td>Stormwater Sampling (PCBs at outfalls)</td>
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<td>Aug-93</td>
<td>Auxiliary Building Air Line Removal (PCBs)</td>
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<td>Nov-93</td>
<td>Stormwater Sampling (PCBs at outfalls)</td>
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<td>May-94</td>
<td>Soil and Groundwater Assessment - Former Pit Nos. 1 - 3 (TPH, PCBs, VOCs, SVOCs, metals)</td>
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<td>Sep-94</td>
<td>Drainline Baseline Pre-Remediation Sampling (PCBs)</td>
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<td>Drainline Systems Decontamination (PCBs)</td>
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<td>Soil Sampling - Former Pit No. 3 (PCBs and TCLP metals)</td>
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<td>Monitoring Well Installation &amp; Sampling - Former Pit No. 3 (TPH, PCBs, VOCs, SVOCs, metals)</td>
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<td>Work Plan for Additional Site Characterization, Soil Remediation, Building and Equipment</td>
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<td>Mar-95</td>
<td>Decontamination, &amp; Wastewater Management System Reconfiguration, Transco Compressor Station 130, Comer, Georgia (Transco, January 1996)</td>
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<td>Groundwater Monitoring - Former Pit No. 3 (TPH, PCBs, VOCs, SVOCs, metals)</td>
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<td>Off-site Soil Sampling (PCBs, TPH, arsenic, mercury, chromium, lead)</td>
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<td>Groundwater Monitoring - Former Pit No. 3 (TPH, PCBs, VOCs, SVOCs, metals)</td>
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<td>Dec-95</td>
<td>Concrete Surface PCB Decontamination Demonstration</td>
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<td>Groundwater Monitoring - Former Pit No. 3 (metals)</td>
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<td>Assessment and Remediation - Station Proper and Area West of Transco Road (PCBs)</td>
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<td>Jun-96</td>
<td>Groundwater Monitoring - Former Pit No. 3 (metals)</td>
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<td>Sep-96</td>
<td>Groundwater Monitoring - Former Pit No. 3 (metals)</td>
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<td>Pre-Construction Sampling - Fiber Optics Line (PCBs)</td>
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<td>Rock Filter Dam Sampling (PCBs)</td>
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<td>Dec-98</td>
<td>Monitoring Well Installation and Sampling - Scrubber Line Leak Area (VOCs, SVOCs)</td>
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<td>Mar-99</td>
<td>Pre-Construction Sampling - Breakroom, Septic and Conduit (PCBs)</td>
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<td>Jun-99</td>
<td>Groundwater Monitoring - Scrubber Line Leak Area (VOCs, SVOCs)</td>
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<td>Rock Filter Dam Sampling (PCBs)</td>
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<td>Groundwater Monitoring - Former Pit 3 (TPH, VOCs, SVOCs, metals)</td>
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<td>Pre-Construction Sampling - Gas Cooler (PCBs)</td>
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<td>Protocol for Pits and Scrubber Line Leaks in the Transco Matter, Attachment A of the Consent Decree in United States of America v. Transcontinental Gas Pipe Line Corporation; Civil Action No. H-02-0387, United States District Court, the Southern District of Texas, entered May 15, 2002</td>
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<td>Aug-02</td>
<td>Phase 1 Conceptual Model and Sampling and Analysis Plan, Transco Station 130 (Transco, August 2002, revised October 2003)</td>
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<td>Apr-04</td>
<td>Phase 2 Soil and Groundwater Assessment - Former Pit Nos. 1 &amp; 2 and SLLA (TPH, VOCs, SVOCs, metals)</td>
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<td>Apr-05</td>
<td>Long-Term Monitoring Well Installation and Sampling - Former Pit Nos. 1 &amp; 2 and SLLA (TPH, VOCs, SVOCs, metals)</td>
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<td>Phase 3 Long Term-Groundwater Monitoring - Former Pit Nos. 1 &amp; 2 and SLLA (TPH, VOCs, SVOCs, metals)</td>
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Total Samples Collected 13,424 1,874 27 185 287 15,797

*Other - Concrete chip, concrete core, or paint chip
## REFERENCES

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<td>Jan-89</td>
<td>Phase I Evaluation of TGPL Compressor Station 130 (Ecology and Environment, June 1989)</td>
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<td>2</td>
<td>May-89</td>
<td>Ecology and Environment Laboratory Report, May 24, 1989</td>
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<td>Jan-90</td>
<td>Report for the Phase II Evaluation of TGPL Compressor Station 130 (Ecology and Environment, September 1990)</td>
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<td>Mar-90</td>
<td>Report for the Phase IIB Evaluation of TGPL Compressor Station 130 (Ecology and Environment, January 1991)</td>
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<td>Apr-90</td>
<td>Law Environmental Laboratory Report, April 9, 1990</td>
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<td>Jul-90</td>
<td>Report for the Phase IIC Evaluation of TGPL Compressor Station 130 (Ecology and Environment, June 1992)</td>
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<td>9</td>
<td>Apr-91</td>
<td>Law Environmental Laboratory Report, April 19, 1991</td>
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<td>10</td>
<td>Jun-91</td>
<td>Closure Report for PCB Removal Project - Air Systems (Quadrax Environmental, November 4, 1992)</td>
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<td>Jul-92</td>
<td>Public Health Risk Assessment and Fate and Transport Assessment, Transcontinental Gas Pipe Line Corporation Station 130, Comer, Georgia (Groundwater Technology, July 1992)</td>
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<td>Jun-93</td>
<td>ASI Analytical Services, Inc. Laboratory Report, July 28, 1993</td>
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<td>13</td>
<td>Aug-93</td>
<td>ASPCI PCB Laboratory Services Laboratory Report, August 16, 1993</td>
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<td>14</td>
<td>Nov-93</td>
<td>ASI Analytical Services, Inc. Laboratory Report, November 22, 1993</td>
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<td>16</td>
<td>Sep-94</td>
<td>Baseline Pre-Remediation Sampling Analytical Results (Rucker Remediation, October 1994)</td>
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<td>18</td>
<td>Oct-94</td>
<td>Terra Labs Laboratory Report, November 15, 1994</td>
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<td>20</td>
<td>Jan-95</td>
<td>Work Plan for Additional Site Characterization, Soil Remediation, Building and Equipment Decontamination, &amp; Wastewater Management System Reconfiguration, Transco Compressor Station 130, Comer, Georgia (Transco, January 1995)</td>
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<td>Jun-95</td>
<td>1995 Remediation Activities (BHE Environmental, Inc., November 15, 2000)</td>
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<td>27</td>
<td>Dec-95</td>
<td>Concrete Surface PCB Decontamination Demonstration (BHE Environmental, Inc., November 16, 2000)</td>
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<td>29</td>
<td>May-96</td>
<td>PCB Oversight and Assessment Report (Eco-Systems, Inc., January 1997)</td>
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## REFERENCES

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<th>Document</th>
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<td>34</td>
<td>Dec-97</td>
<td>Fiber Optics Line Sampling (Zephyr Environmental Corporation, April 12, 1998)</td>
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<td>ASI Analytical Services, Inc. Laboratory Report, July 23, 1998</td>
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<td>Groundwater Investigation of the Scrubber Area (BHE Environmental, February 11, 1999)</td>
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<td>37</td>
<td>Mar-99</td>
<td>PCB Assessment Activities (Zephyr Environmental Corporation, March 24, 1999)</td>
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<td>38</td>
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<td>SPL Laboratory Report, June 16, 1999</td>
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<td>Sep-99</td>
<td>SPL Laboratory Report, October 13, 1999</td>
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<td>Dec-99</td>
<td>SPL Laboratory Report, January 17, 2000</td>
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<td>SPL Laboratory Report, February 2, 2000</td>
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<td>SPL Laboratory Report, July 5, 2000</td>
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<td>43</td>
<td>Jan-02</td>
<td>PCB Pre-Construction Sampling (Portnoy Environmental, Inc. December 2002)</td>
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<td>May-02</td>
<td>Protocol for Pits and Scrubber LineLeaks in the Transco Matter, Attachment A of the Consent Decree in United States of America v. Transcontinental Gas Pipe Line Corporation; Civil Action No. H-02-0387, United States District Court, the Southern District of Texas, Entered May 15, 2002</td>
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<td>45</td>
<td>Aug-02</td>
<td>Phase 1 Conceptual Model and Sampling and Analysis Plan, Transco Station 130 (Transco, August 2002, revised October 2003)</td>
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<td>46</td>
<td>Apr-04</td>
<td>Phase 2 Soil and Groundwater and Soil Corrective Action Report (Brown and Caldwell, et. al., June 2005, revised April 2006)</td>
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<td>47</td>
<td>Apr-05</td>
<td>Phase 3 Long-Term Monitoring Well Installation Report (Brown and Caldwell, et. al., April 2007)</td>
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<td>48</td>
<td>Jan-06</td>
<td>2006 Phase 3 Annual Report (Portnoy Environmental, Inc., et. al., March 2006)</td>
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<td>50</td>
<td>Jul-07</td>
<td>2008 Phase 3 Annual Report (Portnoy Environmental, Inc. et. al., April 2008)</td>
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<td>51</td>
<td>May-09</td>
<td>Phase 3 Groundwater Monitoring and Corrective Action Report, Transcontinental Gas Pipe Line Corporation Station 130 (Comer, GA) (Brown and Caldwell, et. al., May 2009)</td>
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</table>
APPENDIX C: NOTICE OF INVOLVEMENT

CHEMICAL HAZARDS PROGRAM

CONTACT POINTS
State Office Staff
Jane Perry       Program Director
                (404) 657-6534
Franklin Sanchez Health Assessor
                (404) 657-6534
www.ph.dhr.state.ga.us/programs/hazards

NOTICE OF PUBLIC HEALTH INVOLVEMENT

Transcontinental Gas Pipe Line Corporation—Comp Station 130
Madison County, Georgia
HIS ID # 10215

CHEMICAL HAZARDS PROGRAM
DIVISION OF PUBLIC HEALTH

Georgia Department of Human Resources
Division of Public Health
Chemical Hazards Program
2 Peachtree Street, 13th Floor
Atlanta, GA 30303-3142
Notice of GDPH Involvement

The Georgia Division of Public Health (GDPH) will investigate community concerns about the health effects from exposure to chemicals released to the environment from the Transcontinental Gas Pipeline Company, Madison County, Georgia facility. To accomplish this, the following steps will be taken:

- Notice of Involvement sent to nearby residents, community leaders, elected officials, local media, public repositories, regulatory agencies, county health department, etc.
- Site Visits conducted by GDPH staff.
- Interviews/meetings with residents, public officials, etc.
- Consultation and Technical Assistance for state and county agency staff, elected officials, the media, residents, etc.
- Community Needs Assessment working with local communities to identify environmental health education needs and to develop education programs to meet those needs.
- Public Health Actions (public health assessment, community health survey, epidemiologic study, develop/distribute education materials, etc.)

Public Health Assessments and Health Education

The GDPH Chemical Hazards Program (CHP) assists district and county health departments, federal and state regulatory agencies, and residents with public health issues associated with environmental contamination. CHP can address community concerns through public health assessments and health education.

A public health assessment (PHA) provides site-specific information about exposure to hazardous substances in the environment. CHP evaluates all available environmental sampling and health outcome data to determine what chemicals were released to which environmental media (i.e., air, soil, water), and at what levels. The PHA discusses the health effects that may result if exposure occurs at levels that are believed to cause long-term health effects and disease. Also, the PHA addresses community concerns and makes recommendations for additional public health actions, if needed.

Health education (HE) activities are designed to prevent or reduce exposure to hazardous substances in the environment and to inform the public about the possible health effects if exposure occurs. HE is often used as a follow up to a PHA to ensure that affected populations know how to best protect their health.

Community Involvement

With every circumstance where there is real or potential exposure to hazardous substances at levels that may cause long-term health effects and disease, it is essential to involve everyone who is concerned in the process of protecting the community.

In order to accurately and completely gather and address the health concerns of residents, we collaborate with public officials, the health care industry, civic and activist groups, public health agencies, and other citizens and community leaders.

At the beginning of a public health investigation, all of these parties will be informed of our involvement, and urged to participate in the investigation. This is accomplished through community involvement activities such as public meetings, needs assessment activities (i.e., community health surveys) media interaction, and establishing relationships with members of the community.

If you have any information or specific concerns about this site that relate to public health, please contact us using the information provided on the back of this brochure.
APPENDIX D: WATER WELL QUALITY BROCHURE

If I suspect a problem, who should I contact?

If you suspect there may be a problem with your well water, there are some guidelines you need to follow to protect your health.

- Contact a licensed well driller to inspect your water well.
- Have your well tested for bacteria regularly, especially after well water disinfections. Your County Cooperative Extension Service and County Health Department, Environmental Health Section, can test your well water for bacteria.
- Contact your County Health Department, Environmental Health Section, about taking proper care of your septic system. Septic system problems can also affect your well water quality.
- Contact your County Cooperative Extension Agent to test your well water for chemicals.

FOR MORE INFORMATION

Georgia Division of Public Health Chemical Hazards Program
(404) 657-6634
www.health.state.ga.us/programs/hazards

County Health Department
Environmental Health Section
www.health.state.ga.us

University of Georgia
Cooperative Extension Service
County Extension Agent
www.caes.uga.edu/extension

CHEMICAL HAZARDS PROGRAM
Environmental Health Branch

GEORGIA DEPARTMENT OF COMMUNITY HEALTH
Division of Public Health
Is my well water safe?

Having clean well water is important. For homes that use individual water wells, there can be certain risks involved. The water in your well can be exposed to and become contaminated from various hazards. The water in your well can make you sick if it is not safe. Since there are no federal or state monitoring regulations for private wells, it is the homeowner’s responsibility to make sure their well water is safe to drink. Well water may not be safe to drink if:

- you detect a difference in the taste, smell, or appearance of your well water
- you have frequent and unexplained illnesses in your household
- you spill fertilizers, pesticides, oil, gasoline, or other toxic substances on the ground near the well or in the well
- your neighbors find toxic chemicals in their well water

What are some ways to keep my well water safe?

- Doing regular well inspections and disinfections
- Keeping poisons, pesticides, chemicals, and pet waste off the ground and away from your well
- Taking proper care of your septic system
- Having your well professionally tested at least once a year

How do I inspect my well?

Things can enter into your well to harm you and your family. It is important to regularly inspect your well for sources of contamination. Other potential problems can exist with the slab, the well screen, the building covering the well, and/or landscaping. What are some first signs of dangers that you should have a professional examine?

- Cracks and holes in the well casing
- A moveable well casing
- A leaking valve or hearing running water from the casing

Potential sources of well water contamination

Pesticides, including insecticides and herbicides, used to kill bugs and plants should be used sparingly. Fuels like gasoline and oil are also poisons that should not be stored near a well. Do not store gasoline operated equipment such as lawn mowers near your well because gasoline or oil can leak onto the ground and travel to the water that is in your well. It is important to keep assorted chemicals and pet waste 100 feet away from your well. These chemicals and waste can drain onto the ground and get into the water that is in your well.

Buy only enough chemicals like pesticides and fuels that you need. Do not keep half empty containers around or reuse the containers for any other purpose. Wrap empty containers in paper and throw them into the trash or take them to a collection facility for disposal.

Well water disinfection

To disinfect your well, household bleach should be used. The bleach should be poured into the well taking care to inclde the sides of the well. Connect a hose to the nearest faucet and direct water back into the well for about 30 minutes. The entire plumbing system should then be opened until chlorine is smellad in the water and then each opening closed and the chlorinated water allowed to stand in the system at least 10 to 12 hours. Seal all openings into the well (pipe and wire holes) and around the well cap. After chlorine has been in the system for the allotted time, run the plumbing openings until no chlorine is left in the water.
APPENDIX E: MADISON COUNTY JOURNAL ADVERTISEMENT

Community Environmental Health Survey
Madison County, Georgia

Citizens Organized For Pipeline Safety (C.O.P.S.)
And the
Georgia Division of Public Health

ATLANTA (GA) – The Georgia Division of Public Health, Chemical Hazards Program, is encouraging residents living in Madison County to complete a community environmental health survey. The purpose of the survey is to collect community health concerns about underground liquid and gas petroleum pipelines in Madison County. Members of a community advocacy group, Citizens Organized for Pipeline Safety, or C.O.P.S., have expressed concern about the potential for health risks from exposure to contaminants associated with these pipelines and associated distribution facilities in Madison County. C.O.P.S. members are working with CHP staff to develop, distribute, and collect the community environmental health surveys. Information collected from the completed surveys will be used to develop appropriate public health programs for the community.

For more information about C.O.P.S., and to get copies of the survey and assistance with completing and returning it, and if you have questions, please contact Cat Drose at (706) 783-4702.

The survey consists of a 5-page questionnaire that asks about health and environmental concerns, health history, and basic demographic information (age, race, etc. for statistical purposes only). Participation is voluntary and is offered at no cost to residents. Results of this survey are expected to be available to residents in summer 2009. Reports created from the survey results will not contain any personal identifiers such as name or address. These reports will contain grouped information only.

Residents can obtain a survey online at www.health.state.ga.us, or by calling Pamela Noah at 404-657-6534. Surveys are also available at the Madison County Health Department and the Athens Regional Medical Center’s Loran Smith Center for Cancer Support. Individuals can return completed surveys to the health department or the support center. Surveys can also be submitted via mail or fax to the Chemical Hazards Program as instructed on the survey.

For more information on this or any other public health program, please contact:

Pam Noah
Public Health Program Consultant
Chemical Hazards Program
Georgia Division of Public Health
404-657-6534

Thank you for your participation!
COMMUNITY ENVIRONMENTAL HEALTH SURVEYS NOW AVAILABLE

ATLANTA (GA) – The Georgia Department of Human Resources (DHR), Division of Public Health (DPH) is encouraging Madison County residents to complete a community environmental health survey. The purpose of the survey is to collect community health concerns about underground liquid and gas petroleum pipelines within the county.

Members of a community advocacy group, Citizens Organized for Pipeline Safety (C.O.P.S.), have expressed concern about potential health risks associated with exposure to contaminants with these pipelines and distribution facilities in Madison County. C.O.P.S. is working with the GDPH Chemical Hazard Program (CHP) staff to develop, distribute and collect the community environmental health surveys. Information collected from the completed surveys will be used to develop appropriate public health programs for the community.

“This community survey is a very important tool which will help us assess the health concerns of the community,” says Dr. Sandra Elizabeth Ford, acting director of the Division of Public Health.

The survey consists of a five-page questionnaire that asks about health and environmental concerns, health history and basic demographic information (i.e., age, race, etc.). Participation is voluntary and is offered at no cost to residents. Results of this survey are scheduled to be available to residents in summer 2009.

Residents can obtain a survey online at www.health.state.ga.us or by calling (404) 463-3768. Surveys are also available at the Madison County Health Department and the Athens Regional Medical Center’s Loran Smith Center for Cancer Support. Individuals can also return completed surveys to the health department or the support center. Surveys can also be submitted via mail or fax to the Chemical Hazards Program as instructed on the survey.

Surveys results are expected to be available to residents in this summer. Reports created from the survey results will not contain any personal identifiers such as names or addresses. These reports will contain grouped information only.

For more information on this or any other public health program, please contact Pam Noah with the Chemical Hazards Program at (404) 463-3768.
## APPENDIX G: CANCER INCIDENCE

### Age-Adjusted Cancer Incidence Rates for Georgia, 2002 - 2006

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Average annual rate per 100,000, age-adjusted to the 2000 U.S. standard population.

Source: Georgia Comprehensive Cancer Registry, Georgia Department of Community Health, Division of Public Health, 2009.
### Age-Adjusted Cancer Incidence Rates for Madison County, Georgia, 2002 - 2006

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Average annual rate per 100,000, age-adjusted to the 2000 US standard population.
Rates highlighted in yellow are significantly lower than the state rate (p<.05).
Rates highlighted in orange are significantly higher than the state rate (p<.05).

Source: Georgia Comprehensive Cancer Registry, Georgia Department of Community Health, Division of Public Health, 2009.
Madison County Cancer Incidence, 2002-2006

Data Summary

All Cancer Sites
- 687 new cancer cases were diagnosed in Madison County from 2002 to 2006, an average of 137 new cases per year.
- It is expected that about 76 males and 61 females will be diagnosed with cancer every year in Madison County.
- The overall age-adjusted cancer incidence rate in Madison County is 503.8 per 100,000 population. This is significantly higher than the rate for Georgia (462.1 per 100,000).
- Males are 51% more likely than females to be diagnosed with cancer in Madison County.

Males
- The overall age-adjusted cancer incidence rate for males in Madison County is 624.9 per 100,000 population. This is higher than the rate for Georgia males (566.3 per 100,000), but this difference is not statistically significant.
- Prostate, lung, and colorectal are the top cancer sites among males in both Madison County and the State of Georgia.
- The age-adjusted prostate cancer incidence rate is lower for males in Madison County (150.7 per 100,000) than for Georgia males (162.3 per 100,000), but this difference is not statistically significant.
- The age-adjusted lung cancer incidence rate is significantly higher for males in Madison County (131.6 per 100,000) than for Georgia males (101.7 per 100,000).
- The age-adjusted colorectal cancer incidence rate is higher for males in Madison County (72.5 per 100,000) than for Georgia males (58.7 per 100,000), but this difference is not statistically significant.

Females
- The overall age-adjusted cancer incidence rate for females in Madison County is 414.2 per 100,000 population. This is higher than the rate for Georgia females (392.4 per 100,000), but this difference is not statistically significant.
- Breast, lung and colorectal are the top cancer sites among females in both Madison County and the State of Georgia.
- The age-adjusted breast cancer incidence rate is higher for females in Madison County (128.3 per 100,000) than for Georgia females (118.5 per 100,000), but this difference is not statistically significant.
- The age-adjusted lung cancer incidence rate for females in Madison County (53.8 per 100,000) is similar to that for Georgia females (53.3 per 100,000).
- The age-adjusted colorectal cancer incidence rate is higher for females in Madison County (45.8 per 100,000) than for Georgia females (42.3 per 100,000), but this difference is not statistically significant.
### Age-Adjusted Cancer Incidence Rates for Zip Code 30629, Georgia, 2002 - 2006

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<tr>
<td>Leukemias</td>
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</tbody>
</table>

Average annual rate per 100,000, age-adjusted to the 2000 US standard population.
Rates highlighted in yellow are significantly lower than the state rate (p<.05).
Rates highlighted in orange are significantly higher than the state rate (p<.05).

Source: Georgia Comprehensive Cancer Registry, Georgia Department of Community Health, Division of Public Health, 2009.
Zip Code 30629 Cancer Incidence, 2002-2006

Data Summary

All Cancer Sites
- 115 new cancer cases were diagnosed in Zip Code 30629 from 2002 to 2006, an average of 23 new cases per year.
- It is expected that about 11 males and 12 females will be diagnosed with cancer every year in Zip Code 30629.
- The overall age-adjusted cancer incidence rate in Zip Code 30629 is 499.3 per 100,000 population. This is higher than the rate for Georgia (462.1 per 100,000), but this difference is not statistically significant.
- Males are 20% more likely than females to be diagnosed with cancer in Zip Code 30629.

Males
- The overall age-adjusted cancer incidence rate for males in Zip Code 30629 is 575.7 per 100,000 population. This is similar to the rate for Georgia males (566.3 per 100,000).
- Prostate and lung are the top cancer sites among males in both Zip Code 30629 and the State of Georgia.
- The age-adjusted prostate cancer incidence rate could not be calculated because there were fewer than twenty cases, but there does not appear to be an excess of cases.
- The age-adjusted lung cancer incidence rate could not be calculated because there were fewer than twenty cases, but there does not appear to be an excess of cases.

Females
- The overall age-adjusted cancer incidence rate for females in Zip Code 30629 is 479.8 per 100,000 population. This is higher than the rate for Georgia females (392.4 per 100,000), but this difference is not statistically significant.
- Breast, lung and colorectal are the top cancer sites among females in both Zip Code 30629 and the State of Georgia.
- The age-adjusted breast cancer incidence rate could not be calculated because there were fewer than twenty cases, but there does not appear to be an excess of cases.
- The age-adjusted lung cancer incidence rate could not be calculated because there were fewer than twenty cases, but there does not appear to be an excess of cases.
- The age-adjusted colorectal cancer incidence rate could not be calculated because there were fewer than twenty cases, but there does not appear to be an excess of cases.
### Age-Adjusted Cancer Incidence Rates for Zip Code 30633, Georgia, 2002 - 2006

<table>
<thead>
<tr>
<th>Site</th>
<th>Total Cases</th>
<th>Rate</th>
<th>Males Cases</th>
<th>Rate</th>
<th>Females Cases</th>
<th>Rate</th>
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<tr>
<td>All Sites</td>
<td>187</td>
<td>451.0</td>
<td>115</td>
<td>647.7</td>
<td>72</td>
<td>317.1</td>
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<tr>
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<td>64.0</td>
<td>17</td>
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<td>Lung and Bronchus</td>
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<td>83.6</td>
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<td>Kidney and Renal Pelvis</td>
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<tr>
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<td>7</td>
<td>~</td>
<td>***</td>
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<tr>
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<td>Non-Hodgkin Lymphoma</td>
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<td>&lt;5</td>
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<tr>
<td>Multiple Myeloma</td>
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<tr>
<td>Leukemias</td>
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</tr>
</tbody>
</table>

Average annual rate per 100,000, age-adjusted to the 2000 US standard population.
Rates highlighted in yellow are significantly lower than the state rate (p<.05).
Rates highlighted in orange are significantly higher than the state rate (p<.05).

Source: Georgia Comprehensive Cancer Registry, Georgia Department of Community Health, Division of Public Health, 2009.
Zip Code 30633 Cancer Incidence, 2002-2006

Data Summary

All Cancer Sites
- 187 new cancer cases were diagnosed in Zip Code 30633 from 2002 to 2006, an average of 37 new cases per year.
- It is expected that about 23 males and 14 females will be diagnosed with cancer every year in Zip Code 30633.
- The overall age-adjusted cancer incidence rate in Zip Code 30633 is 451.0 per 100,000 population. This is lower than the rate for Georgia (462.1 per 100,000), but this difference is not statistically significant.
- Males are twice as likely as females to be diagnosed with cancer in Zip Code 30633.

Males
- The overall age-adjusted cancer incidence rate for males in Zip Code 30633 is 647.7 per 100,000 population. This is higher than the rate for Georgia males (566.3 per 100,000), but this difference is not statistically significant.
- Prostate, lung, and colorectal are the top cancer sites among males in both Zip Code 30633 and the State of Georgia.
- The age-adjusted prostate cancer incidence rate is lower for males in Zip Code 30633 (151.5 per 100,000) than for Georgia males (162.3 per 100,000), but this difference is not statistically significant.
- The age-adjusted lung cancer incidence rate is higher for males in Zip Code 30633 (143.3 per 100,000) than for Georgia males (101.7 per 100,000), but this difference is not statistically significant.
- The age-adjusted colorectal cancer incidence rate could not be calculated because there were fewer than twenty cases, but there does not appear to be an excess of cases.

Females
- The overall age-adjusted cancer incidence rate for females in Zip Code 30633 is 317.1 per 100,000 population. This is significantly lower than the rate for Georgia females (392.4 per 100,000).
- Breast, lung and colorectal are the top cancer sites among females in both Zip Code 30633 and the State of Georgia.
- The age-adjusted breast cancer incidence rate is lower for females in Zip Code 30633 (101.6 per 100,000) than for Georgia females (118.5 per 100,000), but this difference is not statistically significant.
- The age-adjusted lung cancer incidence rate could not be calculated because there were fewer than twenty cases, but there does not appear to be an excess of cases.
- The age-adjusted colorectal cancer incidence rate could not be calculated because there were fewer than twenty cases, but there does not appear to be an excess of cases.
APPENDIX H: FORMALDEHYDE EXPOSURE IN AMBIENT AIR

Formaldehyde is released to the air from both industrial and natural sources. Combustion processes account directly and indirectly for most of the formaldehyde entering the atmosphere. One important source of formaldehyde is automotive exhaust from engines not equipped with catalytic converters. Photochemical production of formaldehyde from automobiles predominates over direct emissions from automobiles. Naturally occurring formaldehyde also arises from atmospheric oxidation of naturally occurring alkenes.

A survey of emission data from stationary and mobile sources was used as input for an atmospheric dispersion model to estimate outdoor air concentrations in 1990 for each of the 60,803 census tracts in the contiguous United States. The average long-term background concentration estimated for formaldehyde was 0.2 parts per billion (ppb). In a survey of ambient measurements of hazardous air pollutants, a median formaldehyde concentration of 2.5 ppb was found for a total of 1,358 samples collected at 58 different locations, both urban and rural, throughout the United States.

The contribution of various atmospheric environments to the general population’s average exposure to formaldehyde is:

<table>
<thead>
<tr>
<th>Source</th>
<th>mg/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air</td>
<td></td>
</tr>
<tr>
<td>Outdoor air (10% of time)</td>
<td>0.02</td>
</tr>
<tr>
<td>Indoor air</td>
<td></td>
</tr>
<tr>
<td>Home (65% of time)</td>
<td></td>
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<tr>
<td>Conventional</td>
<td>0.5-2.0</td>
</tr>
<tr>
<td>Prefabricated (chipboard)</td>
<td>1.0-10.0</td>
</tr>
<tr>
<td>Workplace (25% of time)</td>
<td></td>
</tr>
<tr>
<td>Without occupational exposure</td>
<td></td>
</tr>
<tr>
<td>With 1 mg/m$^3$ occupational exposure</td>
<td>0.2-0.8</td>
</tr>
<tr>
<td>Environmental tobacco smoke</td>
<td>0.1-1</td>
</tr>
<tr>
<td>Smoking (20 cigarettes per day)</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Formaldehyde is removed from the atmosphere by direct photolysis (from sunlight) and oxidation by photochemically produced free radicals. Based on its rate of reaction with photochemically produced hydroxyl radicals, formaldehyde has a predicted half-life of approximately 19 hours in clean air and about 8 hours in polluted air.

**Literature Review**

A toxicological evaluation of exposure requires a comparison of calculated site-specific exposure doses (e.g., amount of the contaminant believed to enter the body at the person’s body weight for an estimated duration of time) with an appropriate health guideline. Health guidelines are health-protective values that have incorporated various safety factors to account for varying human susceptibility. These guidelines are developed using human exposure data when it is available and animal data when human exposure data is not available. Health guidelines used are the Agency for Toxic Substances and Disease Registry’s (ATSDR) Minimal Risk Levels (MRLs). Usually little or no information is available for a site to know exactly how much exposure is actually occurring, so in some cases, health assessors assume worse case
scenarios where someone received a maximum dose. As a result, actual exposure is likely much less than the assumed exposure. In the event that the calculated, site-specific exposure dose for a chemical is greater than the established health guideline, it is then compared to exposure doses from individual studies documented in the scientific literature that have reported health effects. If a contaminant has been determined to be cancer causing (carcinogenic), a cancer risk is also estimated.

Low levels of formaldehyde can cause irritation of the eyes, nose, throat, and skin. It is possible that people with asthma may be more sensitive to the effects of inhaled formaldehyde. In deriving a chronic inhalation MRL for formaldehyde, a 1989 study correlating histological changes in the nasal mucosa in persons occupationally exposed to formaldehyde was used. Clinical symptoms of mild irritation of the eyes and upper respiratory tract and mild damage to nasal epithelial cells were observed in workers exposed for over 10 years to an average (time-weighted average) concentration of 0.24 parts per million (ppm). This concentration is where the lowest observable adverse health effects levels (LOAEL) were observed in these workers. From the LOAEL, an uncertainty factor of 30 was used to establish the MRL to account for human variability and mild to subclinical histological changes in nasal epithelial cells. Thus, a chronic inhalation MRL for formaldehyde was set at 0.008 milligrams of formaldehyde per kilogram of body weight per day (mg/kg/day).

Let us assume that one is exposed, on a long-term daily basis to the median formaldehyde concentration of 2.5 ppb found at 58 different locations, both urban and rural, across the United States in the survey mentioned above. To approximate an exposure dose for an adult male, let us assume that he weighs 70 kilograms, is outside 10% of the day, and breathes an average of 15.2 cubic meters (m³) of air per day. The chronic exposure dose of this adult male would be approximately 0.00007 mg/kg/day. A young child weighing 25 kilograms, breathing an average of 10 m³ of air per day, and spending 10% of his/her time outdoors would have a formaldehyde exposure of approximately 0.00013 mg/kg/day.

One can see that the exposure doses to both adults and children are significantly lower that the MRL (0.008 mg/kg/day), which is considered to be a health-protective value that has various safety factors incorporated into it to account for varying human susceptibility. Specifically, the adult exposure dose is 114 times lower than the MRL and the child exposure dose is 61 times lower than the MRL.

For a more conservative measure, let us assume that one is exposed, on a long-term daily basis to an average formaldehyde concentration of 0.02 milligrams per day in the contribution of various atmospheric (outdoor air) environments to the general population’s average exposure to formaldehyde above. The chronic exposure dose of this adult male would be approximately 0.0005 mg/kg/day. A young child would have a formaldehyde exposure of approximately 0.001 mg/kg/day. In this case, the adult exposure dose is 16 times lower than the MRL and the child exposure dose is 8 times lower than the MRL, which again, is considered to be a health-protective value that has various safety factors incorporated into it to account for varying human susceptibility.

As referenced below, several ambient air analyses in various communities throughout the United States have been conducted over the last decade. In all cases, average formaldehyde concentrations have ranged between 0.81 ppb to 8.14 ppb. Moreover, at these levels, no adverse health effects were expected from exposure to these levels on a day-to-day basis.

1 Minimal Risk Levels (MRLs) are developed by ATSDR for contaminants commonly found at hazardous waste sites. The MRL is developed for ingestion and inhalation exposure, and for lengths of exposures: acute (less than 14 days); intermediate (between 15-364 days), and chronic (365 days or greater). ATSDR has not developed MRLs for dermal exposure (absorption through skin).
References


APPENDIX I: EXPLANATION OF EVALUATION PROCESS

Step 1—The Screening Process

In order to evaluate the available environmental data, GDPH uses comparison values (CVs) to determine which chemicals to examine more closely. CVs are contaminant concentrations found in a specific environmental media (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 public health assessment 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. When a cancer and non-cancer CV exist for the same chemical, the lower of these values is used as a conservative measure.

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.

Non-cancer Health Risks

The doses calculated for exposure to individual chemicals are then compared to an established health guideline, such as an ATSDR minimal risk level or an EPA reference dose, 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 doses are below the threshold at which adverse health effects are expected.

7 Reference Doses (RfDs): EPA developed chronic RfDs for estimates of daily exposures to a substance that are likely to be without a discernable risk of deleterious effects to the general human population (including sensitive subgroups) during a lifetime of exposure.
values are much lower (and more human health protective) than doses, which do not cause adverse health effects in laboratory animal studies.

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 public health assessment. 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 is calculated by multiplying the site-specific doses by EPA’s chemical-specific cancer slope factors 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 $1 \times 10^{-6}$ 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 a 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 epidemiologic 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 that doses reported in toxicology literature to cause carcinogenic effects. As such, a low cancer risk estimate of $1 \times 10^{-6}$ and below may indicate that the toxicology literature supports a finding that no excess cancer risk is likely. A cancer risk estimate greater than $1 \times 10^{-6}$, however, indicates that a careful review of toxicology literature before making conclusions about cancer risks is in order.

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8ii Cancer Slope Factor (CSF) is a term adopted by EPA to identify the cancer risk associated with a unit dose of a carcinogen. It is the slope of the curve representing the relationship between dose and cancer risk. When estimated with the linearized multistage model, the CSF is the upper 95 percent confidence limit of the slope (upper-bound estimate of risk).
APPENDIX J: GLOSSARY OF TERMS

This glossary defines words used by GDPH in communications with the public. It is not a complete dictionary of environmental health terms.

General Terms

**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.

**Ambient**
Surrounding (for example, ambient air).

**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.

**Biodegradation**
Decomposition or breakdown of a substance through the action of microorganisms (such as bacteria or fungi) or other natural physical processes (such as sunlight).

**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 monitoring.

**Biota**
Plants and animals in an environment. Some of these plants and animals might be sources of food, clothing, or medicines for people.

**CAP/CAG** [see Community Assistance Panel/Community Advisory Group].

**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.

**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.

Community Assistance Panel (CAP) / Community Advisory Group (CAG)
A group of people from a community and from health and environmental agencies who work with ATSDR to resolve issues and problems related to hazardous substances in the community. CAP/CAG members work with ATSDR to gather and review community health concerns, provide information on how people might have been or might now be exposed to hazardous substances, and inform ATSDR on ways to involve the community in its activities.

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.

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.

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.

Delayed health effect
A disease or an injury that happens as a result of exposures that might have occurred in the past.

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.

Disease registry
A system of ongoing registration of all cases of a particular disease or health condition in a defined population.

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** (for radioactive chemicals)
The radiation dose is the amount of energy from radiation that is actually absorbed by the body. This is not the same as measurements of the amount of radiation in the environment.

**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.

**Epidemiologic surveillance** [see Public health surveillance].

**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.

**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 investigation**
The collection and analysis of site-specific information and biologic tests (when appropriate) to determine whether people have been exposed to hazardous substances.

**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.

**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.

**Groundwater**
Water beneath the earth’s surface in the spaces between soil particles and between rock surfaces [compare with surface water].

**Hazard**
A source of potential harm from past, current, or future exposures.

**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.

**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].

**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].

**In vitro**
In an artificial environment outside a living organism or body. For example, some toxicity testing is done on cell cultures or slices of tissue grown in the laboratory, rather than on a living animal [compare with in vivo].

**In vivo**
Within a living organism or body. For example, some toxicity testing is done on whole animals, such as rats or mice [compare with in vitro].

**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.
mg/kg
Milligram per kilogram.

mg/m³
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].

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 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.

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).

Potentially responsible party (PRP)
A company, government, or person legally responsible for cleaning up the pollution at a hazardous waste site under Superfund. There may be more than one PRP for a particular site.

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].

Prevalence survey
The measure of the current level of disease(s) or symptoms and exposures through a questionnaire that collects self-reported information from a defined population.

Prevention
Actions that reduce exposure or other risks, keep people from getting sick, or keep disease from getting worse.

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.

RCRA [see Resource Conservation and Recovery Act (1976, 1984)]

Receptor population
People who could come into contact with hazardous substances [see exposure pathway].

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.

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 reduction
Actions that can decrease the likelihood that individuals, groups, or communities will experience disease or other health conditions.

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.

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.
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].

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.

Uncertainty factor
Mathematical adjustments for reasons of safety when knowledge is incomplete. For example, factors used in the calculation of doses that are not harmful (adverse) to people. These factors are applied to the lowest-observed-adverse-effect-level (LOAEL) or the no-observed-adverse-effect-level (NOAEL) to derive a minimal risk level (MRL). Uncertainty factors are used to account for variations in people's sensitivity, for differences between animals and humans, and for differences between a LOAEL and a NOAEL. 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 [also sometimes called a safety factor].

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.

Other glossaries and dictionaries
Environmental Protection Agency (www.epa.gov/OCEPAtersms)