Health Consultation

COPPER BASIN MINING DISTRICT

COPPERHILL, POLK COUNTY, TENNEESSEE

EPA FACILITY ID: TN0001890839

MAY 24, 2005

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

Health Consultation: A Note of Explanation

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

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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Prepared by:

U.S. Department of Health and Human Services
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May 19, 2005

Prepared by:

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Background

On March 27, 2001, a citizen and former worker in the Copper Basin Mining District site petitioned the Agency for Toxic Substances and Disease Registry (ATSDR) to conduct a health assessment in the Copper Basin area. The petitioner asked that a morbidity and epidemiologic study be performed on current active workers, retired workers, former inactive workers, and the local population in the Copper Basin Mining and Smelter District. The petitioner also requested that the study included everyone affected by the mining, milling, and smelting operations past and present [1]. This health consultation was prepared in response to the petitioner's request to ATSDR.

The Copper Basin is near the junctions of Tennessee, North Carolina, and Georgia. It covers about 60,000 acres, most of which lie in Polk County, Tennessee [2]. Copper Basin was formerly the site of extensive copper and sulfur mining operations that date back to 1843, when copper was first discovered there. In 1861, trees were becoming scarce in Copper Basin [3]. Trees were cut down and used to fuel open-pit smelting of the raw ore. The escaping smoke and other steps in the smelting process released sulfur dioxide into the air. Soon, the area's vegetation was either removed for fuel or killed by acid aerosol. This, combined with steep terrain and more than 60 inches of rainfall yearly, created severe erosion [4]. In all, about 32,000 acres were disturbed by the smelter fumes. The first replacement trees were planted in 1939 through a joint effort by the Tennessee Copper Company and the Tennessee Valley Authority (TVA). As of 1984, more than 14 million trees had been planted to help revegetate the area [3].

Throughout the 150 years of mining operations, numerous companies and individuals were involved in mining, refining, and manufacturing in the area. In 1963, Cities Service Company acquired certain properties and assets in the Copper Basin from the Tennessee Corporation. In 1982, Occidental Petroleum Corporation (OXY USA) acquired Cities Service Company and all its assets (and liabilities). In the same year, Cities Service Company sold its Copper Basin assets to the Tennessee Chemical Company, which filed for bankruptcy in 1989 [4]. The bankruptcy trustee sold part of the land owned by Tennessee Chemical and abandoned the rest. In 1990, Boliden Intertrade purchased the production facilities and approximately 1,600 acres of the former Tennessee Chemical property. Intertrade Holdings, Inc., a subsidiary of Boliden Intertrade, operated the facility [5].

Around 1987, the Environmental Protection Agency (EPA) began investigating the site and documented its negative environmental impact [4]. Mining and related activities have resulted in environmental degradation of portions of the Copper Basin, including North Potato Creek Watershed, Davis Mill Creek Watershed, and parts of the Ocoee River. Acidic conditions and leaching metals have impaired water quality, and deforestation has resulted in severe erosion. In addition, abandoned and collapsed mine works and other deteriorating facilities and waste piles pose substantial physical hazards. Despite considerable improvements in erosion control and habitat restoration, the Copper Basin remains environmentally degraded from the continuing presence and movement of pollutants or contaminants from within abandoned mines, hazardous substances, various waste materials, surface soils, and sediments [2].

Environmental Protection Agency Involvement

The site is currently being investigated and cleaned up through a collaborative effort that was formalized on January 11, 2001, in a Memorandum of Understanding (MOU), and several legal agreements, between the EPA, the Tennessee Department of Environment and Conservation (TDEC), and OXY USA, Inc. The MOU provides an overall framework and establishes roles and responsibilities amongst the three parties for this investigation and cleanup work. It also provides assurance from the federal government not to list, or propose to list, the site on the Superfund National Priorities List (NPL) as long as other terms of the MOU are met [2].

OXY USA has conducted a study to evaluate alternatives to treat the North Potato Creek at its mouth (before it enters the Ocoee River). EPA selected a method to treat the North Potato Creek based on results of this study. OXY USA agreed to implement the selected remedy, which consists of treating the creek with lime and using the South Mine Pit as a settling basin for metals that precipitate out of the water [2]. The North Potato Creek water treatment plant began operation in January 2005.

OXY USA is providing for treatment of the Davis Mill Creek before it enters the Ocoee River. Treatment of Davis Mill Creek in the Cantrell Flats Treatment System began in November 2002. In the first year of treatment, more than two million pounds of metals that would otherwise have entered the Ocoee River were removed from Davis Mill Creek water. OXY also agreed to divert relatively clean water from two tributaries of Davis Mill Creek away from mine wastes and downstream of the Cantell Flats intake [2].

OXY USA will implement several short term "interim actions" in the North Potato Creek watershed under a state order. This order also requires OXY to evaluate and carry out more comprehensive remedial actions that will meet performance standards defined and developed for the North Potato Creek watershed [2].

EPA will conduct a Remedial Investigation and Feasibility Study (RI/FS) in the Davis Mill Creek watershed. OXY USA has agreed to deposit a total of $3 million into a special account to partially fund the RI/FS and final cleanup of the Davis Mill Creek watershed. In addition, OXY USA has agreed to deposit a total of $2 million dollars into an account that TDEC will use to plant hardwood trees and other vegetation [2].

In accordance with provisions of the MOU, EPA will conduct a Remedial Investigation and Feasibility Study on the Ocoee River. The Baseline Human Health Risk Assessment on the Ocoee River and its reservoirs was completed in 2003. The rest of the RI/FS, including the ecologic risk assessment, is being conducted in phases as outlined in the Project Management Plan for the Ocoee River. The first part of this RI/FS addresses the reach of the Ocoee River from Davis Mill Creek down to the slack water of the Ocoee #3 reservoir [2].

National Institute for Occupational Safety and Health Involvement

In the petition dated March 27, 2001, the petitioner asked that a morbidity and epidemiologic study be performed on current active workers, retired workers, former inactive workers, and the local population located in the Copper Basin Mining and Smelter District [1]. However, a response letter sent to the petitioner let him know that ATSDR does not conduct public health assessments of on-the-job exposures or studies of workers [6]. ATSDR then contacted the National Institute for Occupational Safety and Health (NIOSH) to learn about their current activities in the Copper Basin Mining District site.

NIOSH is conducting an epidemiologic study of mortality patterns among former employees of the Copperhill smelter. NIOSH and researchers at the University of Pittsburgh and University of Illinois are carrying out the study. The study cohort includes male workers employed three or more years in the smelter, mill, or sulfur operations between 1/1/46 and 4/30/96. Vital status of cohort members was ascertained through 2000, and cause of death information will be obtained for all deceased cohort members. Data analysis will involve comparing the mortality experience of cohort members with mortality patterns in the United States and relevant state and county populations. To assess the relationship between occupation and observed mortality, data analysis will also examine mortality patterns by job title, work area, and specific workplace exposures. NIOSH expects to complete the study by late spring 2005, and will develop a plan to share the study findings with interested community residents and former workers [7].

Community Health Concerns

The petitioner included a list of health problems believed to be attributed to the environment the people of Copper Basin live in. Conditions the petitioner presented included, but were not limited, to the following:

Respiratory – acute sinusitis, asbestosis, asthma, bronchitis, chronic obstructive pulmonary disease (COPD), emphysema, lung disease, shortness of breath, silicosis, tuberculosis

Cardiovascular – hypertension, heart disease, heart attack

Hematologic – blood disorders

Immunologic – diabetes

Musculoskeletal – multiple sclerosis (MS)

Neurologic – amyotrophic lateral sclerosis (Lou Gerhrig's disease), stroke, Parkinson's disease

Hepatic – liver failure, liver disease, acute hepatitis

Renal – kidney disease

Dermal – psoriasis

Carcinogenic endpoints - adenocarcinoma, bone, brain, breast, bladder, cervical, colon, esophagal, intestinal, leukemia, liver, lung, lymphoma, ovarian, pancreatic, prostate, rectal, skin, stomach, throat

Other - arthritis, back/neck pain, hearing loss, mental retardation, hypothyroidism, hyperthyroidism (Graves disease), sleep apnea, thyroid disease, ruptured pancreas, allergies, brain aneurysm, Alzheimer's disease

The Agency for Toxic Substances and Disease Registry Involvement

ATSDR completed several Health Consultations for the Copper Basin Mining District concerning localized contamination of groundwater, surface water, well water, and surface soils [8, 9, 10].

Community Involvement Plan for the Copper Basin Mining District Site

The community involvement plan provides background information and describes community interests and concerns related to the Copper Basin Mining District site in Polk County, Tennessee. It also outlines the community involvement program that the Copper Basin Site Community Involvement Partnership implemented or coordinated during various stages of investigation and cleanup of the Copper Basin Mining District site. Partnership members include the U.S. Environmental Protection Agency, Tennessee Department of Environment and Conservation, and Glenn Springs Holdings, Inc. (a wholly owned subsidiary of Occidental Petroleum Corporation).

The Copper Basin site community involvement program has three goals:

1. Provide consistent, accurate, and timely information about site activities to all interested stakeholders.
2. Provide opportunities for interested stakeholders to ask questions, express concerns, and offer suggestions or other kinds of information to TDEC, Glenn Springs Holdings , and EPA during cleanup and restoration activities for the Copper Basin site.
3. Meet the terms and spirit of the Memorandum of Understanding, the accompanying enforcement actions, the National Contingency Plan, and other applicable federal and state statutory and regulatory requirements.

This plan is intended to be flexible, and program aspects will be modified as needed to respond to community interest and suggestions [5].

Toxic Release Inventory – Air Emissions

The Toxics Release Inventory (TRI) is a publicly available EPA database that contains information on toxic chemical releases and other waste-management activities reported annually by certain industry groups as well as federal facilities. Intertrade Holdings, Inc. is the only remaining company listed on the TRI database. According to TRI database, Intertrade Holdings, Inc. released both fugitive air emissions and air stack emissions. Fugitive air emissions are not released through stacks, vents, ducts, pipes, or any other confined air stream. Fugitive air emissions from the facility include copper compounds, N,N-dimethylaniline, sulfuric acid, toluene, and xylene. The facility also released copper compounds, N,N-dimethylaniline, sulfuric acid, and xylene from their stack emissions. The only chemicals reported by Intertrade Holdings, Inc. in the years 2001 and 2002 were toluene and xylenes. The table below summarizes the quantities of chemicals the facility released to the air, by reporting year [11]. Appendix A contains a toxicologic summary of these compounds.

Table 1: Amounts of chemicals (pounds) reported released to the air in EPA TRI data for Intertrade Holdings, 1992 to 2002 [11]

Year	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Fugitive Air											
Copper Compounds	250	250	250	250	5	NR	NR	NR	NR	NR	NR
N,N-Dimethylaniline	250	250	250	250	5	5	330	360	263	NR	NR
Sulfuric acid*	250	250	250	NR	NR	NR	NR	NR	NR	NR	NR
Toluene	250	250	250	250	250	250	210	503	342	334	334
Xylene (mixed isomers)	750	750	750	250	250	NR	NR	NR	NR	NR	914.1
Air Stack											
Copper Compounds	3600	4800	4800	3600	250	NR	1600	NR	NR	NR	NR
N,N-Dimethylaniline	3380	3200	7900	7900	17000	7400	5000	5400	3941	NR	NR
Sulfuric acid*	53000	50000	70000	NR	78000	78600	16000	18400	17754	NR	NR
Xylene (mixed isomers)	250	250	2000	2000	750	NR	NR	NR	NR	NR	NR

NR = signifies nothing reported for this facility
* = 1994 and after, “acid aerosols” only

Air emissions data and historical copper mining and acid production activities in the basin indicates the community may have been exposed to copper and acid aerosol in the past. ATSDR is not aware of any historical air-sampling data collected in the community to assess the community’s exposure to air contaminants during full-scale smelting or acid production.

Health Statistics Review

ATSDR reviewed nonmalignant respiratory disease and lung cancer mortality rates for Polk County from 1990 through 1998. ATSDR selected this timeframe because data were readily available for this period. ATSDR obtained age-adjusted mortality rates from the Tennessee Department of Health website [12] and reported deaths per 100,000 for white males and females. ATSDR compared Polk County mortality rates to age-adjusted rates for Johnson County, TN, and the entire state of Tennessee. Johnson County is in northeastern Tennessee and has demographic characteristics (population, racial make-up, high school graduation percentage, per capita money income) similar to Polk County [13].

Results are reported in Figures 1 through 4.

Nonmalignant respiratory disease mortality rates for white females in Polk County (Figure 1) exceeded comparison population rates for the period 1990-1992. However, the mortality rate for Polk County was below comparison population rates for the period 1993 through 1998.

Nonmalignant respiratory disease mortality rates for white males in Polk County (Figure 2) was higher than both comparison rates for all time periods (1990-1992 and 1996-1998).

Rates of lung and thoracic cancer mortality for white females in Polk County (Figure 3) were slightly higher than the state rate for the periods 1990-1992 and 1993-1995. The Polk County rate was less than the state rate for the period 1996-1998.

The rate of lung and thoracic cancer mortality for white males in Polk County (Figure 4) was higher than both comparison population rates for the period 1990-1992. The Polk County rate declined for the period 1993-1995 and was close to Johnson County and state rates for the period 1996-1998.

ATSDR does not have sufficient information to determine whether elevated rates for non-malignant respiratory disease mortality in Polk County white males during 1990 - 1992 and 1996 - 1998, or elevated rates of lung cancer for males and females during 1990 – 1992 for males and females, are due to smoking, past occupational exposure to workplace contaminants, or other factors.

Child Health Considerations

In communities faced with air, water, or food contamination, the many physical differences between children and adults demand special emphasis. Children could be at greater risk than are adults from certain kinds of exposure to hazardous substances. Children play outdoors and sometimes engage in hand-to-mouth behaviors that increase their exposure potential. Children are shorter than are adults; this means they breathe dust, soil, and vapors close to the ground. A child’s lower body weight and higher intake rate results in a greater dose of hazardous substance per unit of body weight. If toxic exposure levels are high enough during critical growth stages, the developing body systems of children can sustain permanent damage. Finally, children are dependent on adults for access to housing and medical care and for risk identification. Thus adults need as much information as possible to make informed decisions regarding their children’s health. Children living in the Copper Basin area were likely exposed to air contaminants in ambient air from smelting and acid-production activities.

Conclusions

For periods 1990 -1992 and 1996 - 1998, the rates of mortality from non-malignant respiratory disease in white males living in Polk County were elevated compared with rates for the state of Tennessee and a comparison county. For the period 1990-1992, lung and thoracic mortality of persons living in Polk County were elevated compared with rates for the state of Tennessee and a comparison county. Available health statistics data do not allow determination of the causes from these elevations.

Because historical air monitoring data for the Copper Basin community are lacking, ATSDR considers past community exposure to copper smelting and acid aerosol as an indeterminate past public health hazard.

Currently no copper or acid aerosol emissions are occurring in the Basin because copper smelting and sulfuric acid manufacturing operations have ceased.

Recommendation

No specific public health recommendations are provided for this health consultation.

Action Plan

ATSDR will share this health consultation with the petitioner and participants of the community involvement plan.

Upon request from EPA or others, ATSDR will review relevant data concerning air quality in the Copper Basin Mining District.

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Appendix A

Copper Compounds

Copper is a reddish metal that occurs naturally in rock, soil, water, sediment, and, at low levels in air. It is also found in many mixtures of metals, called alloys, such as brass and bronze. Many compounds (substances formed by joining two or more chemicals) of copper exist. These include naturally occurring minerals as well as manufactured chemicals. Copper is mined and processed extensively in the United States and is used primarily as the metal or alloy in the manufacture of wire, sheet metal, pipe, and other metal products.

Copper is essential for good health. However, exposure to high doses can be harmful. Long-term exposure to copper dust can irritate the upper respiratory tract and eyes and can cause headaches, dizziness, nausea, and diarrhea. EPA does not classify copper as a human carcinogen because no adequate human or animal cancer studies exist [14].

N,N-dimethylaniline

N,*N*-Dimethylaniline is used as an intermediate in the manufacture of dyes and other products and as a solvent for special purposes, as a rubber vulcanizing agent and, as a stabilizer. *N*,*N*-Dimethylaniline is present in certain antibiotics (penicillin and cephalosporin) as an impurity, and potential exposure of the public exists through their use [15].

Excess exposure to N,N-dimethylaniline affects the ability of the blood to carry oxygen. The earliest visible effect may be a bluish color of the skin, especially the lips. If the lack of oxygen becomes severe, a person may experience drowsiness, headache, nausea, and vomiting [16]. No information is available on the carcinogenic effects of *N*,*N*-dimethylaniline in humans. EPA has not classified *N*,*N*-dimethylaniline for potential carcinogenicity [15].

Sulfuric acid

Sulfuric acid is a clear, colorless, oily liquid that is very corrosive. It is also called sulphine acid, battery acid, and hydrogen sulfate. It is used in the manufacture of fertilizers, explosives, other acids, and glue; in the purification of petroleum; in the pickling of metal; and in lead-acid batteries (used in most vehicles).

Breathing sulfuric acid aerosol can result in tooth erosion and respiratory-tract irritation. The International Agency for Research on Cancer (IARC) has determined that occupational exposure to strong inorganic acid mists containing sulfuric acid is carcinogenic to humans. IARC has not classified pure sulfuric acid for its carcinogenic effects [17].

Toluene

Toluene is a clear, colorless liquid with a distinctive odor. Toluene occurs naturally in crude oil and in the tolu tree. It is also produced in the manufacture of gasoline and other fuels from crude oil and of coke from coal. Toluene is used in making paints, paint thinners, fingernail polish, lacquers, adhesives, and rubber and in some printing and leather-tanning processes.

Toluene may affect the nervous system. Low-to-moderate levels can cause tiredness, confusion, weakness, drunken-type actions, memory loss and nausea and loss of appetite, hearing, and color vision. These symptoms usually disappear when exposure ceases. Inhaling high levels of toluene in a short time can cause light-headedness and dizziness. It can also cause unconsciousness, and even death. High levels of toluene may affect the kidneys. Studies in humans and animals generally indicate that toluene does not cause cancer. The EPA has determined that the carcinogenicity of toluene cannot be classified [18].

Xylene

Xylene is a colorless, sweet-smelling liquid that catches fire easily. It occurs naturally in petroleum and coal tar and is formed during forest fires. Chemical industries produce xylene from petroleum. The volume of xylene is in the top 30 of chemicals produced in the United States. Xylene is used as a solvent and in the printing, rubber, and leather industries. It is also used as a cleaning agent, a thinner for paint, and in paints and varnishes. It is found in small amounts in airplane fuel and gasoline.

Xylene affects the brain. High levels from short periods of exposure (14 days or less) or long periods (more than 1 year) can cause headaches, lack of muscle coordination, dizziness, confusion, and changes in one's sense of balance. Exposure to high levels of xylene for short periods can also cause irritation of the skin, eyes, nose, and throat; difficulty in breathing; problems with the lungs; delayed reaction time; memory difficulties; stomach discomfort; and possible changes in the liver and kidneys. Very high levels can cause unconsciousness and even death. The International Agency for Research on Cancer (IARC) has determined that the carcinogenicity of xylene in humans is not classifiable. Human and animal studies have not shown xylene to be carcinogenic, but these studies are not conclusive and do not provide enough information to conclude whether xylene causes cancer [19].

Figure 1. Age-adjusted mortality rates for nonmalignant respiratory disease in white females

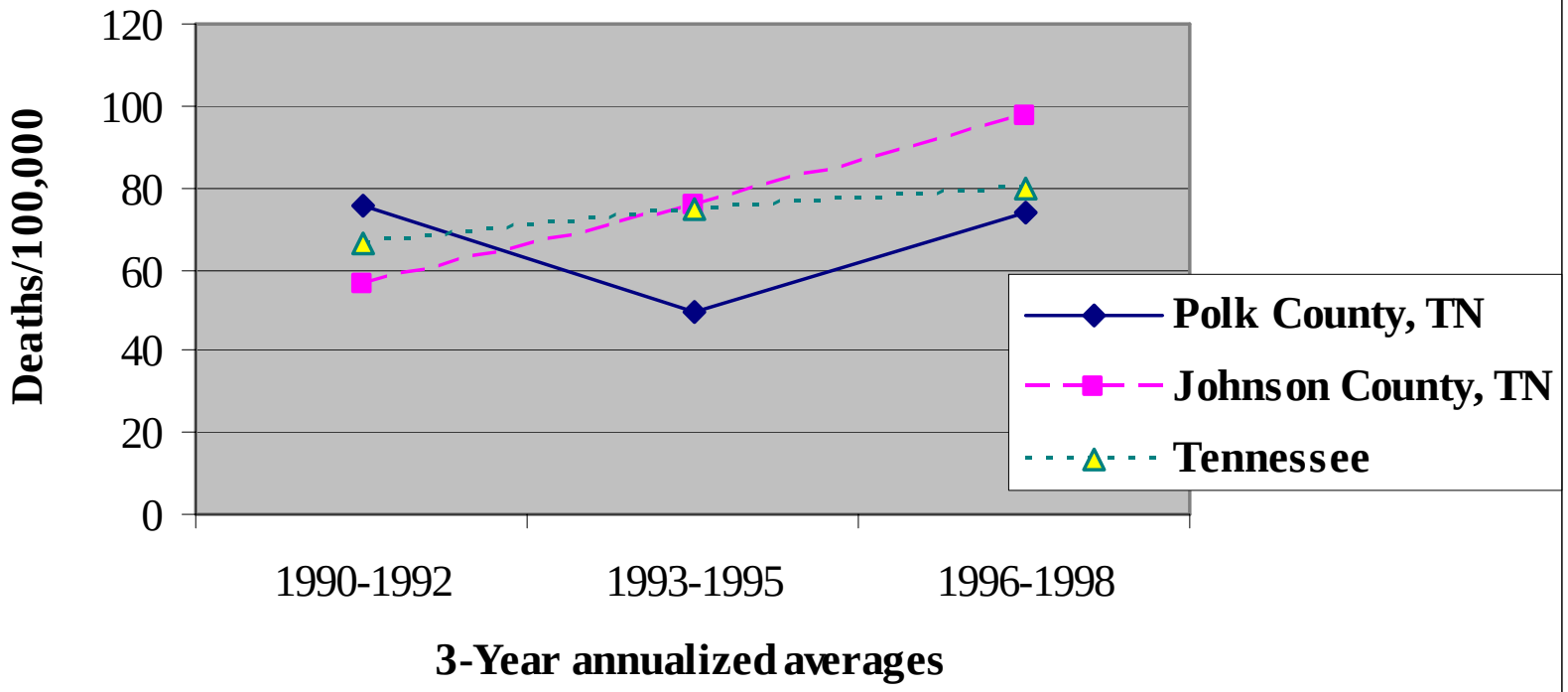

Figure 2. Age-adjusted mortality rates for Nnnmalignant respiratory disease in white males

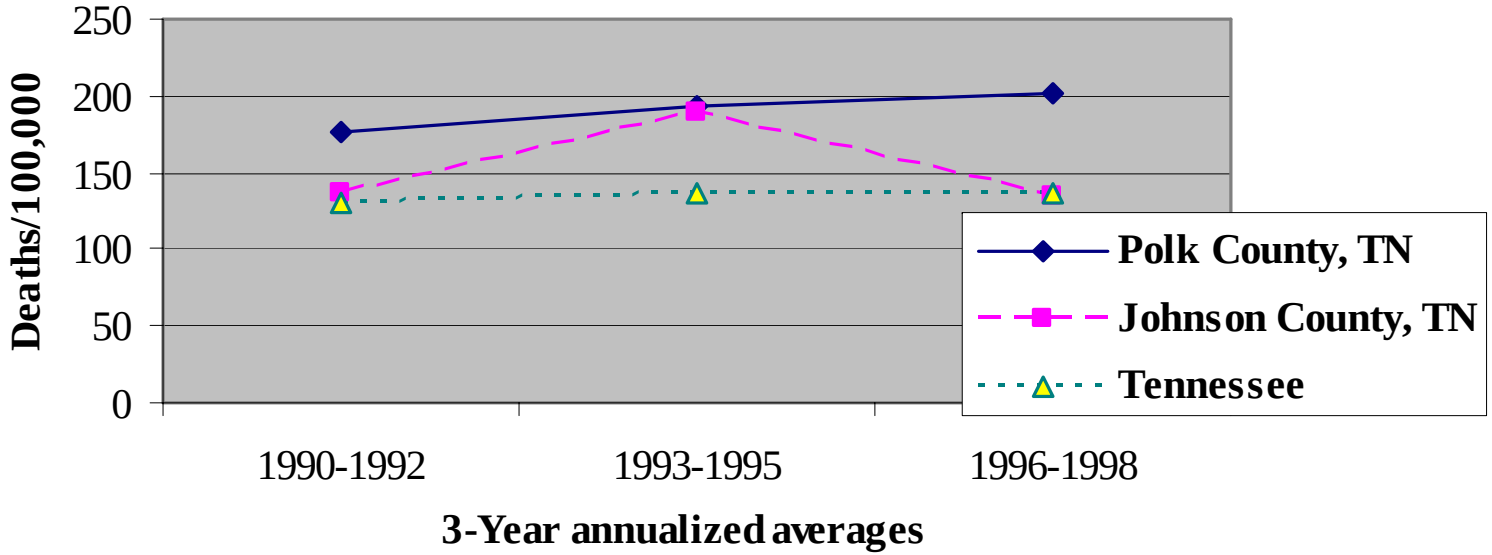

Figure 3. Age-adjusted mortality rates for lung and thoracic cancer in white females

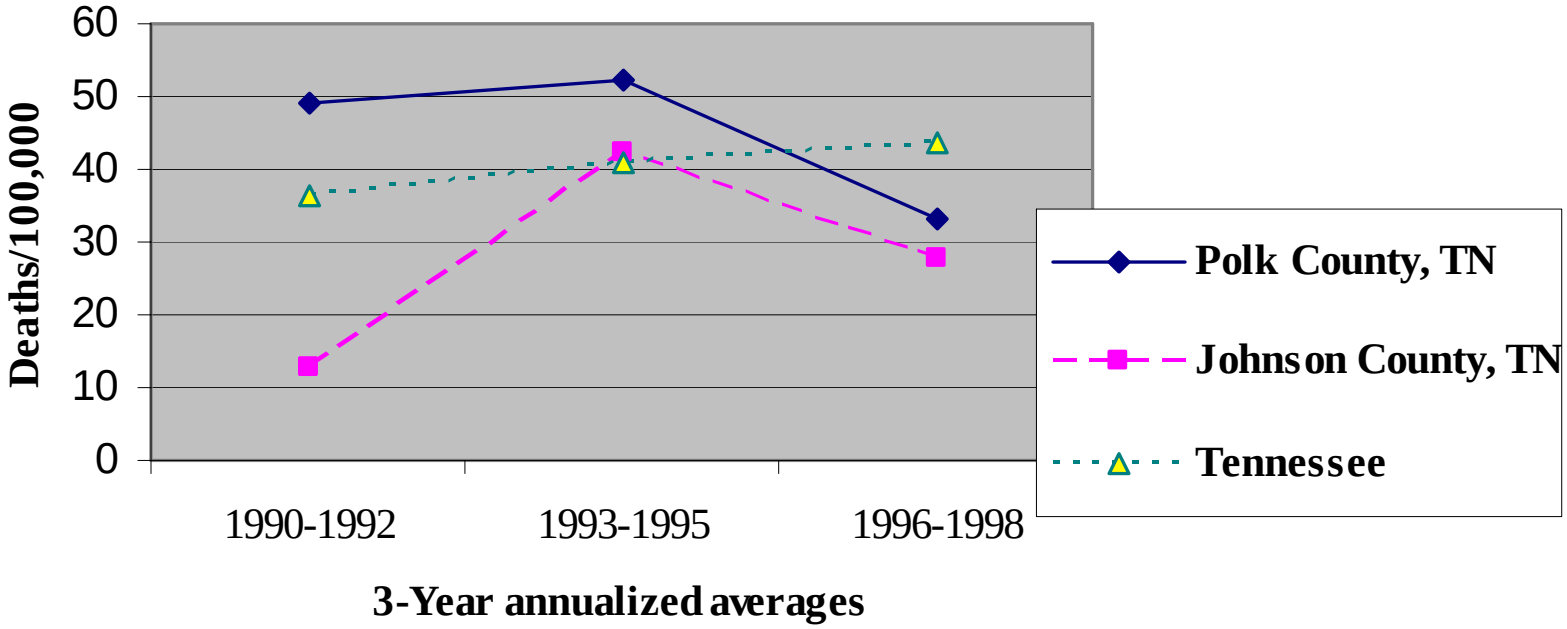

Figure 4. Age-adjusted mortality rates for lung and thoracic cancer in white males