Public Health Assessment

Capitol City Plume

Montgomery, Montgomery County, Alabama
CERCLIS No. AL0001058056

Prepared by the

Alabama Department of Public Health
Under a Cooperative Agreement With the
Agency for Toxic Substances and Disease Registry

Foreword

The Agency for Toxic Substances and Disease Registry (ATSDR) was established by Congress in 1980 under the Comprehensive Environmental Response, Compensation, and Liability Act, also called the *Superfund* law. That law set up a fund to pay for identifying and cleaning up our country's hazardous waste sites. The U.S. Environmental Protection Agency (EPA) and state environmental agencies oversee the site investigation and clean-up actions. Historically, public health assessments are conducted by environmental and health scientists from ATSDR. In 1993, the Alabama Department of Public Health (ADPH) entered into a cooperative agreement with ATSDR, under which ADPH would develop the capacity to carry out this function for ATSDR.

In 1986, the Superfund Amendments and Reauthorization Act (SARA, Title III) required ATSDR to conduct a public health assessment at each site added to the EPA National Priorities List (NPL). Public health assessments seek to discover whether people are being exposed to hazardous substances. Under the 1993 cooperative agreement and subsequent renewals, this responsibility has been assumed by ADPH for sites in Alabama. If people are exposed or have the potential to be exposed, ATSDR decides whether the exposure is harmful and at what level health effects might occur. From these data, a determination can be made whether the exposure should be stopped or reduced.

Exposure: ADPH health assessors review environmental data to see how much contamination is at a site, where it is, and how people might come into contact with it. ADPH typically does not collect and analyze environmental samples, but, instead, reviews sampling data provided by EPA, other government agencies, businesses, or the public. Where there is not enough environmental information available, the assessment will indicate that further sampling data are needed.

Health Effects: If the review of the environmental data shows that people have or could come into contact with hazardous substances, ADPH scientists evaluate whether that exposure may result in harmful effects. ADPH, as well as ATSDR, recognizes that children, because of their play activities and their smaller body size, may be most susceptible to these effects. As a policy, unless data are available to suggest otherwise, ADPH health professionals responsible for assessing effects in populations consider children to be more sensitive and vulnerable to hazardous substances. Thus, the health impact to children is considered first when evaluating the health threat to a community. The health impact to other high risk groups within the community (i.e., elderly, those with compromised immune systems, chronically ill, women of child-bearing age, and people engaging in high risk practices) also receive special attention during the evaluation.

ADPH uses existing scientific information that can include the results of medical, toxicological, and epidemiologic studies and disease registry data to determine the health effects that may result from exposure. The science of environmental health is still developing, and sometimes scientific information on the health effects of certain substances may not be available. In such cases, the report will document the need for further data collection activities.

Conclusions: The report assigns an ATSDR public-health-hazard category and describes any hazards found at the site. The report contains a public-health action plan that recommends ways to stop or reduce exposure. Because ATSDR and ADPH are advisory agencies and not regulatory agencies, the report identifies actions that are appropriate for EPA, other responsible parties, or the research or education divisions of ATSDR to conduct. However, if an urgent public health hazard exists, ATSDR can issue a public health advisory to warn people of the danger. When appropriate, ATSDR also authorizes health education or pilot studies of health effects, full-scale epidemiology studies, disease registries, surveillance studies, or research on specific hazardous substances.

Interactive Process: The development of a health assessment is an interactive process. The approach requires accumulation of information from many sources, including, but not limited to the following: ATSDR; many city, state, and federal agencies; the companies responsible for cleaning up the site, the entities that may have caused the contamination, and the community. Once an assessment has been completed, the conclusions are shared with all interested parties, who are asked to comment on an early draft of the report to make sure the data they provided are presented correctly and responsibly. Sometimes agencies will begin to carry out recommendations when they read the draft conclusions and recommendations.

Community: ADPH needs to determine what people in the area know about the site and what health concerns they have about the site. Therefore, ADPH gathers information and comments from the public. The public is broadly defined to include people who live or work nearby, property owners, business owners, civic leaders, health professionals, community groups, and anyone else who is interested or concerned. The public is asked to comment on a draft of the report to ensure that the report addresses their health concerns. The final report will contain a written response to public comments submitted to the Alabama Department of Health

Comments: If you have questions or comments after reading this report, please contact:

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List of Acronyms and Abbreviations

ADEM	Alabama Department of Environmental Management
ADPH	Alabama Department of Public Health
ATSDR	Agency for Toxic Substances and Disease Registry
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylene
CCP	Capitol City Plume
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
EPA	U.S. Environmental Protection Agency
MCL	Maximum Contaminant Level
MRL	Minimal Risk Level
MWWSSB	Montgomery Water Works and Sanitary Sewer Board
NPL	National Priorities List
NWF	North Well Field
PCE	tetrachloroethylene (also called tetrachloroethene or perchloroethylene)
ppb	parts per billion
ppm	parts per million
QA/QC	Quality Assurance/Quality Control
RMEG	Reference Dose Media Evaluation Guide
RSA	Retirement Systems of Alabama
TCE	trichloroethylene (also called trichloroethene)

Executive Summary

The Alabama Department of Public Health (ADPH) has a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR) to conduct public health assessments at hazardous waste sites in Alabama. ADPH conducted an assessment of the Capitol City Plume (CCP) site, which is required when the U.S. Environmental Protection Agency (EPA) proposes to add a site to the National Priorities List (NPL). For the CCP site, ADPH reviewed available environmental data and information about the community. The purpose of this report is to present an evaluation of existing information, identify any exposure pathways, document potential public health hazards, and, if needed, recommend ways to protect public health.

On the basis of this assessment, ADPH concludes the following:

1. Currently, no residential or municipal wells that are still in use are known to be contaminated. Therefore, ADPH concludes that the CCP site currently represents *No Apparent Public Health Hazard* to residents with regard to drinking water because since no known exposure via drinking water is believed to be occurring.

2. In 1991 and 1992, water analyses of Well 9 W by the Montgomery Water Works and Sanitary Sewer Board (MWWSSB) detected tetrachloroethylene (PCE) at levels above the maximum contaminant level (MCL) for drinking water. ADPH understands that the well was taken out of service in 1992. Therefore, ADPH concludes that the CCP site represented *No Apparent Public Health Hazard* in the past. How long might have exposures occurred in the past? This is due to the quick response by MWWSSB in removing the well from service. Any contaminants that may have been present would have been greatly diluted due to blending in the Montgomery water supply system.

3. If the plume is left unchecked and no remedial action is taken, the contaminated plume could possibly continue to migrate toward the North Well Field (NWF). Well number 2, 18, and 20, screened in the shallow aquifer, are used during periods of drought. These wells could potentially be affected in the future if remedial activities on the plume are not completed. Improperly constructed or improperly abandoned wells in the NWF may serve as conduits for water from the shallow aquifer to migrate downward into the deeper aquifers. Although possible, it is unlikely that the plume would reach NWF because the low-lying area, where Cypress Creek enters Cypress Inlet along the bank of the Alabama River, would interrupt flow in this direction. Surface and subsurface water from the north and south sides of Cypress Creek appear to enter the Alabama River at this low-lying area.

4. In 1993, excavation workers at the Retirement Systems of Alabama (RSA) Energy Plant construction site experienced a completed acute exposure pathway to PCE and trichloroethylene (TCE) in groundwater and subsurface soil. ADPH concludes that the CCP site represents *No Apparent Public Health Hazard* to these workers because the duration of exposure was short. However, business, real estate, and government professionals anticipate further downtown and riverfront development, thus creating the potential for future exposures for excavation workers. The CCP site was determined to represent an *Indeterminate Public Health Hazard* to future

excavation workers because contaminant levels and exposure duration are not known at this time.

5. Workers who use a shallow-groundwater industrial well for daily vehicle washing operations could have been potentially exposed to PCE and TCE. ADPH is unaware of any health condition(s), among these workers which could be associated with these contaminants, and ADPH concludes that the CCP site currently poses *No Apparent Public Health Hazard*.

6. Contaminated groundwater is approximately 50 feet below ground surface (bgs), and vapor intrusion is unlikely at this site.

On the basis of these conclusions, ADPH recommends the following:

Pre-excavation sampling should be conducted at future excavation sites to identify the presence of any contamination. Workers employed at contaminated sites should have proper Occupational Safety and Health Administration (OSHA) training and follow applicable OSHA guidelines to prevent the possibility of exposure to contamination.

MWWSSB tests the city drinking water on a daily basis using state and Federal Water Quality Standards to assure the drinking water is safe for the public. Periodic sampling of the EPA wells and the NWF should continue to monitor for the presence of contaminants. Regardless of whether contaminants are detected, the results should be forwarded to ADPH for evaluation and for inclusion into the site administrative record. Additionally, the industrial well should continue to be sampled to identify and quantify any contaminants, as well as the potential exposure to contaminated groundwater used for washing operations. Whether or not contaminants are detected, the results should be forwarded to ADPH for evaluation and for inclusion into the site administrative record.

A survey was not conducted to locate any existing basements within the area known to be contaminated. Owners of residences with basements should call the Montgomery Fire Department, the Alabama Department of Environmental Management (ADEM), and the ADPH if vapors or odors are detected in a basement.

If you have questions or comments after reading this report, please contact

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Purpose and Health Issues

The Alabama Department of Public Health (ADPH) has a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR) to conduct public health assessments at hazardous waste sites in Alabama. ADPH conducted an assessment of the Capitol City Plume (CCP) site. An assessment is required when a site is proposed for inclusion on the U.S. Environmental Protection Agency (EPA) National Priorities List (NPL). The purpose of this report is to present an evaluation of existing information, to identify any exposure pathways, to document potential public health hazards, and to recommend ways to protect public health.

Environmental Data
Environmental data are results of laboratory testing of samples of environmental media (i.e., air, soil, water, or food taken from a site location. These data show the date and location of samples, specific contaminants present, and the amount (or concentration) of those contaminants. If people could come in contact with any contaminated media, the concentrations can be used to determine whether sufficient contaminants could enter the body to cause adverse health effects.

Information About the Community
Information about the community includes the facilities used by the public, demographics, and public input. This information identifies 1) activities that could bring people into contact with contaminated media, 2) environmental health education needs, and 3) specific health problems or certain events about which people are concerned. ADPH evaluates whether health concerns could be related to the site and focuses on any specific illnesses that are toxicologically related to exposures at the site.

Health Outcome Data
Health outcome data are rates of some diseases or health conditions physicians have reported for their patients, which are linked to the patient's residential address, to determine if something in the area may be causing a health hazard. These data can sometimes help determine whether people at a site are experiencing more disease than expected amount. However, CCP workers, who live in at least six different counties, comprise the majority of the site population. Therefore, health outcome data accurately describing the health status of the occupationally exposed CCP-site population are not available.

This public health assessment will provide information on 1) selected site-related contamination, 2) the potential for public contact with contaminants, 3) the public health implications of contact, and 4) how to protect public health. Please see Appendix D for a glossary of environmental terms.

Background

Site Description and Location

The CCP hazardous waste site is located in downtown Montgomery, Alabama (Figure 1). A hazardous waste site is a place where hazardous substances have been released into the

environment, and under certain conditions, might be harmful to people who come into contact with these substances. The CCP site consists of one or more contaminated groundwater plumes.

> *Groundwater*–When rain falls to the ground, the water does not stop moving. Some of it flows along the surface in ditches, streams, or lakes, some of it is used by plants' some evaporates and returns to the atmosphere, and some sinks into the ground. Groundwater is the water that sinks into the ground, filling the spaces around underground soil, sand, and rock.
>
> *Groundwater plume*–A groundwater plume is a line or column of underground water that contains chemical(s). A plume usually moves away from the place the contaminant(s) entered the water and toward other areas.

The primary contaminant of concern at the CCP site is tetrachloroethylene (also called perchloroethylene or PCE). The source or sources of contamination, or the time-frame during which the contaminant entered the environment at the CCP site have not been identified. Several businesses that might have used this substance have operated in the area (1,2). The only known source of contamination that was found was soils at the Retirement Systems of Alabama (RSA) Tower Energy Plant, and that source of PCE has been removed. The EPA area of investigation includes the monitoring wells, temporary wells, and several municipal drinking water wells shown in Figure 2.

The CCP-site area is estimated to include at least 30 square blocks. A larger area targeted for public health interest more than doubles the geographic area. For this public health assessment, the CCP site includes the EPA area of investigation, plus an expanded buffer zone in the direction of groundwater flow. The area reviewed in this public health assessment also encompasses the municipal wells in north Montgomery (Figure 2).

The ground surface at the site is highest at the southeastern end, sloping downward to its lowest point at the Alabama River at the northwest end of the site. The high end is approximately 290 feet above mean sea level and drops to approximately 170 feet within 0.3 miles. The ground surface then slopes more gradually to approximately 165 feet at the river (3). Surface water runoff is collected by a storm sewer system that was built in approximately 1860. No description or diagram of the storm sewer system is available, but MWWSSB reports that all sewer lines in the area empty into the Alabama River (2).

The CCP site is located over an alluvial aquifer of sandy clay and gravel residuum that could range from 30 to 80 feet bgs. The aquifer is highly permeable, meaning that rainwater not captured by the storm sewer system can quickly sink into the ground. Below the alluvial aquifer is the Eutaw Formation. The Eutaw Formation is hydraulically connected to the alluvial aquifer, meaning that water from the alluvial aquifer also can sink readily into the Eutaw Formation (2). The alluvial aquifer and the Eutaw Formation, together, also may be called the shallow aquifer. Groundwater in the shallow aquifer flows from the southeast to the north northwest, toward the river. At the bottom of the Eutaw Formation, a layer of sandy clay separates the formation from the Gordo Formation below. This confining layer might prevent water in the shallow aquifer

from sinking into the Gordo Formation. The Gordo Formation also is an aquifer, and groundwater flow is from the southeast to the northwest within the aquifer (4).

Site and Investigation History

In 1993, soil containing PCE was excavated during construction of the Retirement Systems of Alabama (RSA) Tower Energy Plant. The soil was removed and disposed of properly. The discovery of PCE in soil prompted the Alabama Department of Environmental Management (ADEM) to conduct a preliminary assessment of the area near the construction site, in accordance with the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLA is a federal law concerning hazardous substances in the environment and protection of public health. The ADEM Preliminary Assessment, dated February 1995, concluded that groundwater at the site was contaminated with PCE (5).

In 1991 and 1992, MWWSSB detected PCE in Municipal Well 9 W. The well was taken out of service to protect the city's drinking water system. Well 9 E is next to Well 9 W and is approximately the same depth. Well 9 E also was removed from service in 1997 because of contamination and the structural condition of the well (5).

In 1996, ADEM performed a site investigation to assess the threat to human health and the environment. ADEM concluded that the site could pose a serious threat to much of Montgomery's north and west well fields. These wells have been reported to provide as much as 34 percent of Montgomery's water supply. The ADEM Site Investigation report, dated March 1996, recommended that EPA evaluate the site further under CERCLA (5).

In 1999, MWWSSB conducted an investigation of groundwater and the storm-water system in the downtown area and found similar contamination in groundwater (5). In 2000, EPA began a remedial investigation (RI) as recommended by ADEM by installing monitoring wells. EPA sampled the soil taken from holes bored to construct wells. The soil and groundwater samples, taken in 2000, were analyzed and evaluated for data quality. EPA sampling data detected PCE and TCE. During Phase II of the RI during January 2001, additional monitoring wells were dug and sampled. In Phase III of the RI during February 2002, two permanent monitoring wells and three temporary wells were installed. These five wells and other industrial wells were sampled (8). Contaminants found during the February 2002 sampling round are listed in Appendix A.

On the basis of a review of documentation ADEM provided under the provisions of CERCLA, EPA proposed to list the CCP site on the NPL. The proposal was published in the *Federal Register* on May 11, 2000. The NPL is an EPA list of the most serious, uncontrolled or abandoned, hazardous-waste sites that are identified for possible long-term remedial response. EPA may use money from a special trust fund (also called *Superfund*) to conduct these remedial responses (42USC9628).

For more information, public documents for the CCP site are available for review at:

Montgomery Library Main Branch
245 High Street
Montgomery, AL. 36104

Demographics, Land Use, and Natural Resources Use

The CCP site is located in a downtown business, governmental, and industrial area of Montgomery, Montgomery County, Alabama. The population is predominately workers who commute from at least six counties into downtown Montgomery. Based on the numbers of workers in selected buildings, ADPH estimated the number of workers to be between 10,000 and 20,000. Workers are employed by a variety of private, public, and governmental institutions. Workers vary widely with respect to race, income, and education levels. ADPH assumes worker ages range from 18 to 65 years of age. Local residents make up a smaller portion of the population. Based on the number of homes and apartments, ADPH estimated the number of residents to be approximately 1,675. Residents also vary widely with respect to age, race, income, and education levels. Children at the CCP site include resident children and approximately 200 who commute into attend day care centers (6).

Much of the area is covered by paved city streets and parking lots; stone- or concrete-covered sidewalks; and public, private, and government buildings. Spaces that lack hard surfaces include Well-landscaped, grass-covered parks, residential yards that vary with regard to vegetative cover, partially vegetated vacant lots, industrial property, and railroad tracks (6).

MWWSSB reports active customers in the area, but it is not aware of anyone using groundwater from domestic wells. ADPH Bureau of Clinical Laboratories does not receive samples for bacteriological analysis from addresses in the area. No on-site well survey has been conducted because no evidence exists to justify such a survey.

Municipal water has been available to the area since 1885. MWWSSB operates a blended-water system that takes water from the Tallapoosa River, the West Well Field, and the North Well Field (NWF). The Wellhead Protection Plan, dated April 1997, reports that in 1990, approximately 5 percent of the MWWSSB total water supply came from the NWF. Raw water from the NWF is pumped to the Court Street Pump Station for storage and treatment. The water is treated as needed with fluoride and chlorine. After treatment, the water is pumped into the water system for delivery to customers (4). MWWSSB serves 220,002 people. MWWSSB provides 40 percent of the water supply of the Pintlala Water and Fire Protection Authority, which serves 3,819 people. MWWSSB also provides 75 percent of the water supply of the Hunter Walk Manufactured Home Community that serves 597 people (2).

Five of the 15 wells in the NWF range in depth from 70 feet to 79 feet bgs, and draw water from the shallow aquifer (Wells 2, 9 W, 9 E, 18, and 20). One of the 15 wells in the NWF is 270 feet deep, and it only draws water from the Gordo Formation (Well 11). Eight of the 15 wells in the NWF range from 600 feet to 755 feet bgs. Two of those wells draw water from the Gordo Formation (Wells 7 and 14). All eight of those wells draw water from the Coker Foundation (Wells 5, 7, 8, 13, 14, 51, 52, and 53) (4).

A prominent natural resource, the Alabama River, is located at the northwestern portion of the CCP site. The river is classified as a fish and wildlife area and a water contact sport area (2). Development along the riverfront has created tourist and recreation attractions, including a minor league baseball stadium, an amphitheatre, a marina, a park with a public boat landing, riverboat

rides, and a renovated train station. The Montgomery Civic Center is adjacent to the south side of the park. Business, real estate, and government professionals are planning further downtown and riverfront development. Other downtown tourist attractions include Old Alabama Town, the Civil Rights Museum, the Dexter Avenue King Memorial Baptist Church, the Rosa Parks Museum, and the Hank Williams Museum. Combined, these facilities attract millions of visitors annually (3, 6).

ADPH and ATSDR Involvement

ADPH, under a cooperative agreement with ATSDR, attended public meetings held by EPA and the City of Montgomery. ADPH reviewed existing data and conducted a site visit with EPA in May 2000, as well as several subsequent site visits to collect information about the community. ADPH announced the public health assessment activity; solicited community involvement through mailings, the Internet, and interviews. ADPH provided further information about the public health assessment process on the Internet. ATSDR provided technical assistance and toxicological resources to ADPH throughout the process.

Quality Assurance and Quality Control

The quality of this public health assessment is dependent upon the quality and quantity of the sampling data and information evaluated. ADEM, EPA, and MWWSSB produced sampling data for this evaluation. ADPH reviewed available information on the chain of custody, laboratory QA/QC, and data-reporting procedures provided in documents referenced in this report. ADPH also reviewed field notes, maps, diagrams, photographs, and site descriptions for assistance in interpreting sampling data. Environmental sampling was conducted by EPA-certified laboratories, using approved methods; therefore, ADPH found the data quality to be acceptable.

Discussion

Environmental Contamination and Exposure

Several investigations and sampling events have been conducted at the CCP site since 1993. Sampling data are reported in documents referenced in this report. ADPH screened the substances reported in sampling data to select those that require a public health evaluation. Each substance was screened by comparing its concentration level in the environment with ATSDR health-based comparison values.

Comparison values are set *below* the levels that would be expected to harm public health to assure a margin of safety to the public. ADPH emphasizes that comparison values are screening tools for health assessments, and are *not* to be confused with clean-up levels, health-effect levels, or toxicity levels.

Substances at the CCP site that were found at levels above comparison values are called the *contaminants of concern*, which are the subject of public health assessment. Substances for which no comparison values have been established are automatically assigned contaminant of concern status.

When a substance is released into the environment, it enters the air, soil, water, or food chain. That release does not always cause human exposure. People are exposed only if they come into contact with the substance. Exposure may occur through breathing, eating or drinking, or skin contact. Many things determine whether exposure will result in adverse health effects:

- exposure dose (how much),
- exposure duration (how long),
- exposure frequency (how often),
- how contact occurred,
- exposure to other substances,
- age, sex, and family traits,
- health habits, and
- health status.

To best serve the interests of the community, a public health assessment describe exposure scenarios that reflect realistic human activity and then selects appropriate comparison values. In this public health assessment, ADPH relied upon statements from the community, health and environmental personnel, publicity regarding future development, and site observations to define any potential exposures to all substances selected for evaluation.

Groundwater Contamination

In this document, ADPH evaluated PCE and TCE groundwater-sampling data produced by MWWSSB, ADEM, and EPA. Water results are reported in parts per billion (ppb)

In 1991 and 1992, MWWSSB detected PCE levels in Wells 9W and 9E ranging from non-detectable to 21.0 ppb. Well 9W was taken out of service in 1992. Since that time, sampling of Well 9W detected levels ranging from non-detectable to 58.1 ppb (7). Well 9E remained on standby until 1997, when it was closed due to contamination and structural problems. The PCE level in well 9E at that time was 4.23 ppb.

In 2000, EPA sampling of shallow and deep aquifers in their area of investigation detected PCE levels ranging from non-detectable to 85.0 ppb. Their sampling detected TCE levels ranging from non-detectable to 18.0 ppb (8).

EPA field activities for this site's Remedial Investigation include the collection of subsurface soil and groundwater samples in three phases. A total o16 permanent and 16 temporary monitoring wells were installed during the three phases of the RI. Analytical results for groundwater samples collected during the RI indicate that the upper aquifer at the CCP site has been affected by past waste disposal practices in the downtown Montgomery area. Several compounds were detected at elevated concentrations when compared to the Federal Drinking Water Maximum Contaminant Levels (MCL). PCE was the organic contaminant detected at elevated concentrations in the most wells. The 2002 sampling of shallow and deep aquifers by EPA detected PCE levels ranging from 1.0 ppb to 240 ppb (8).

Soil

Very little soil contamination is present in the Capitol City Plume site area. Except for benzo(a)pyrene in one sample, no organic contamination was detected at elevated levels. Inorganic contaminants were detected in some samples; however, the levels were low (Table 1).

In 1993 and 1994, ADEM conducted sampling of subsurface (from 4 to 34 ft.) soil in the vicinity of the RSA Energy Plant detected PCE levels ranging from non-detectable to 7843.0 parts per million (ppm) (2). Soil removal was accomplished at this site.

In 2000, EPA sampling of subsurface soil in its area of investigation detected PCE levels ranging from non-detectable to 2.0 ppm. Their sampling detected TCE levels ranging from non-detectable to 9.0 ppm (8).

EPA conducted additional sampling in 2002. Neither PCE nor TCE were reported in the analysis of the subsurface-soil samples. RI sampling results do not provide strong evidence that contaminated soil is a significant source of groundwater contamination (8).

Exposure Pathways

ADPH analyzed multiple exposure-pathway scenarios to groundwater and subsurface soil. Exposure pathway descriptions for residents and workers are based on past events, information in public documents, and information from the community. Exposure pathway scenarios are described below.

PCE and TCE were discovered during excavation of the RSA Energy Plant in 1993 (2). A completed exposure pathway to PCE and TCE existed in the past for excavation workers. A potential future exposure pathway to PCE and TCE exists for excavation workers in further development of the downtown area.

An industrial well on North Court Street has been in use for approximately 35 years. The well draws water from the shallow aquifer and is used daily in a vehicle (bus) washing operation (4). A potential past exposure pathway to PCE and TCE exists for washing-operation workers. Testing of this well in 2002 did not show any contamination from PCE or TCE.

A second industrial well (an irrigation well used to water grass) in downtown Montgomery was also tested in 2002. The presence of PCE was noted, but at a level below the Maximum Contaminant Level (MCL).

Well 9W was taken out of service in 1992 after PCE was detected at levels above the MCL. The well draws water from the shallow aquifer (2, 7). A potential past exposure pathway to PCE existed for customers if contaminated water was distributed.

Improperly constructed or improperly abandoned wells that extend through clay layers into the Gordo Formation and the Coker Formation exist in the NWF area. Potentially, contaminants could move downward through these openings in the clay layers into the lower aquifers, contaminating active MWWSSB wells in the NWF (4). A potential future exposure pathway to PCE and TCE exists to MWWSSB customers if contaminated water is distributed.

Many single-family residences in the area are at least 60 years old, and most residents are of low socioeconomic status (6). A *Potential Past Exposure Pathway* to PCE and TCE exists for

households that have used groundwater from domestic wells. No domestic wells are currently in use in the downtown Montgomery area.

No completed pathway for subsurface soils in the downtown Montgomery area has been identified. It is unlikely that children will be digging in this area. Limited exposure for adults during construction activities could occur.

Many of the metals detected in groundwater-monitoring wells are essential nutrients and are at levels that should not cause any adverse health effects because of dilution in the blended-water system.

Toxicological Evaluation

Introduction

Contaminants of concern at this site were selected from those chemicals found at concentrations that exceeded a health-based comparison value in at least one environmental medium (e.g., air, water, soil). Lifetime (70 years) exposure to chemical concentrations at or below the appropriate comparison values for a chemical would not result in any significant risk for cancer or non-cancer health effects. Comparison values used in this assessment include the following:

ATSDR Environmental Media Evaluation Guides (EMEGs)

ATSDR Cancer Risk Evaluation Guides (CREGs)

Reference Dose Media Evaluation Guides (RMEGs), computed from EPA

Reference Dose (RfD) for chronic exposure of a child, assuming pica behavior for soil ingestion

EPA Drinking Water Health Advisories-Lifetime (LTHA)

EPA Safe Drinking Water Act Maximum Contaminant Levels (MCL)

If no comparison values for a chemical in a medium exist, or no CREG is available for a carcinogen, the chemical is retained for further evaluation. In addition, if the community has expressed specific concerns about exposure to a specific chemical, that chemical will be retained as a contaminant of concern. See Appendix A for a list of contaminants of concern in the relevant environmental media for which exposure potentially could occur at the CCP site (Tables 1, 2, and 3).

Typically, the toxicological evaluation in a public health assessment is a comparison of the estimated exposure dose (i.e., the amount of a substance to which individuals in an exposure pathway are exposed daily) with an appropriate health guideline. The guideline is usually either the ATSDR Minimal Risk Level (MRL), the EPA Reference Dose (RfD), or the U.S. Food and Drug Administration (FDA) Acceptable Daily Intake (ADI). The MRLs and RfDs are estimates of daily human exposure to a contaminant below which noncarcinogenic adverse health effects

are unlikely to occur. Therefore, a review of the toxicological literature is conducted to determine whether the specific exposure situation represents a hazard to public health.

Chemicals of Concern:

Many of these substances may have been used or stored over several decades at a variety of the businesses operating in downtown Montgomery (1, 2). The types of businesses could include, for example, dry cleaners, service stations, auto repair shops, printers. Although numerous possible sources exist, EPA did not locate any other sources of contamination other than the one found at the RSA Energy Power Plant in downtown Montgomery.

a. Tetrachloroethylene

Tetrachloroethylene is a manufactured nonflammable liquid solvent that is widely used in dry cleaning, wood processing, fabric manufacturing, and metal degreasing. It readily evaporates into the air and has a sharp, sweet odor. Other names for tetrachloroethylene include PCE, "perc," perchloroethylene, and tetrachloroethene (9).

People are exposed to PCE most often when they use it in their work, when cleaning, or when engaged in hobbies. Clothes that have been dry cleaned also will release PCE into the air. You also can be exposed through contaminated drinking water. Small amounts of PCE can pass through the skin when people handle the chemical, contaminated soil, or bathe in contaminated water. High levels of PCE (particularly in closed, poorly ventilated areas) can cause dizziness, headache, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death. People at this site are not expected to be exposed to levels that could cause these symptoms.

Results from some studies suggest that women, who work in dry cleaning industries, where exposures to PCE can be quite high, may have more menstrual problems and spontaneous abortions than women who are not exposed. However, it is not known whether PCE was responsible for these problems because other possible causes were not considered. The health effects of breathing in air or drinking water with low levels of PCE are not known. The U.S. Department of Health and Human Services (DHHS) had determined that PCE may reasonably be anticipated to be a carcinogen.

Contaminated wells at this site were capped when PCE was detected. The contaminated wells are not in use, and ADPH has determined that the site does not pose a current public health hazard.

b. Lead

Exposure to lead can cause adverse health effects, especially for young children and pregnant women, or women of childbearing age. Lead uptake by pregnant women or women of childbearing age can move through the placenta and into the developing fetus. Lead is a neurotoxin that permanently interrupts normal brain development. Lead is known to accumulate in the body and has no beneficial biological function. ATSDR has not developed a health guideline for lead because no safe threshold has been identified. FDA published a provisional,

tolerable daily lead-intake value of 6 micrograms (µg) for a 10-kilogram (kg) child, based on an acceptable blood lead level of 10 micrograms per deciliter (µg/L). A survey of a variety of foods determined the average adult lead intake to be 54 micrograms per day (µg/day) (10).

The Centers for Disease Control and Prevention (CDC) considers lead poisoning the number one preventable pediatric health problem facing children today. Several signs of lead toxicity have been described at low levels of exposure. Symptoms include decreased attention span, hyperactivity, and lower IQ scores. Lead levels as low as 10 micrograms/deciliter (µg/dL) have been shown to affect child development. Several studies provide sufficient evidence that children's cognition is adversely affected by lead (10).

Lead is a cumulative poison, in that many small doses have the same effect as a single large dose. Lead primarily attacks the nervous system. Lead also interferes with growth and development of the nervous system. Some laboratory animals that were fed a diet containing lead developed cancers of the liver or kidneys. EPA has classified lead as a probable human carcinogen (EPA Class B2). Insufficient information is available to evaluate the risk of contracting cancer from exposure to lead (10).

No health guidelines have been developed for exposure to lead in soil, so the exposure doses for lead in this medium cannot be evaluated directly. Only one in 66 soil samples at this site demonstrated the presence of lead at a level of 2500 mg/kg. EPA allows 1000 mg/kg of lead at remedial site. Downtown Montgomery is primarily a commercial site. Exposure to lead in subsurface soil at this site is highly unlikely.

Lead also was detected in monitoring wells at the CCP site. Should water from the municipal wells in the area contain lead, it would be diluted due to the blending of water in the water system.

c. Chromium

Chromium in the environment occurs primarily in the trivalent state (III), which is the most stable form, or in the hexavalent state (VI), which is a strong oxidizing agent. Trivalent chromium is thought to be an essential nutrient required for sugar and fat metabolism. Normal dietary intake of chromium for humans is believed to be suboptimal. The estimated safe and adequate daily dietary intake for trivalent chromium is 50 to 200 µg. However, trivalent chromium has a very large safety range, and no documented signs of chromium toxicity at levels up to 1 milligram (1000 µg) per day have appeared in any of the nutritional studies. Most diets are thought to contain less than 60% of the minimum suggested daily intake of 50 µg. As a nutrient, chromium will be of benefit only to those who are marginally or overtly chromium deficient (11).

Hexavalent chromium is recognized by the International Agency for Research on Cancer (IARC) and by DHHS as a carcinogen. The increased risk of cancer occurs through inhalation and affects primarily the lung. Although individual studies suggest the possibility of an excess incidence of cancer at sites outside the lung, the results from these studies are inconsistent. Further, studies have shown that the available evidence strongly indicates that hexavalent chromium is changed

(reduced) in body fluids and tissues to the trivalent form, which reduces its potential toxicity and genotoxicity. Animal studies have not shown trivalent chromium to be carcinogenic by ingestion. Therefore, even in the respiratory tract, which is the only consistent target of hexavalent chromium carcinogenicity in humans, barriers exist to hamper chromium carcinogenicity.

One in 66 soil samples showed the presence of chromium at this site. Fifty-six of 66 shallow and intermediate groundwater samples showed chromium present. Exposure to chromium in the subsurface soil and groundwater at this site is unlikely. Excavation activities in downtown Montgomery could expose workers to contaminants in the soil. This exposure however would be minimal and should pose no health hazards.

d. Arsenic

Arsenic is a naturally occurring element widely distributed in the earth's crust. In the environment, arsenic is combined with oxygen, chlorine, and sulfur to form inorganic arsenic compounds. Arsenic in animals and plants combines with carbon and hydrogen to form organic arsenic compounds (12).

Inorganic arsenic compounds are mainly used to preserve wood. Organic arsenic compounds are used as pesticides, primarily on cotton plants.

Breathing high levels of inorganic arsenic can give one a sore throat or irritated lungs. Ingesting high levels of inorganic arsenic can result in death. Lower levels of arsenic can cause nausea and vomiting, decreased production of red and white blood cells, abnormal heart rhythm, damage to blood vessels, and a sensation of "pins and needles" in hands and feet.

Ingesting or breathing low levels of inorganic arsenic for a long time period can cause a darkening of the skin and the appearance of small "corns" or "warts" on the palms, soles, and torso (12).

Several studies have shown that inorganic arsenic can increase the risk of lung, skin, bladder, liver, kidney, and prostate cancers. The World Health Organization (WHO), DHHS, and EPA have determined that inorganic arsenic is a human carcinogen (12).

It is not known whether exposure to arsenic will result in birth defects or other developmental effects in humans. Birth defects have been observed in animals exposed to inorganic arsenic. It is likely that adverse health effects seen in children exposed to high amounts of arsenic will be similar to the effects seen in adults.

Exposure to arsenic in the subsurface soil and groundwater at this site is unlikely. Excavation activities in downtown Montgomery could expose workers to contaminants in the soil; however, this exposure would be minimal and should pose no health hazards.

e. Antimony

Antimony is a silvery-white metal that is found in the earth's crust. Antimony ores are mined and then mixed with other metals to form antimony alloys or combined with oxygen to form antimony oxide (13).

Little antimony is currently mined in the United States. It is brought into this country from other countries for processing. However, companies in the United States do produce antimony as a by-product of smelting lead and other metals.

Antimony is not used alone because it breaks easily, but when mixed into alloys, it is used in lead storage batteries, solder, sheet and pipe metal, bearings, castings, and pewter. Antimony oxide is added to textiles and plastics to prevent them from catching fire. It is also used in paints, ceramics, and fireworks, and as enamels for plastics, metal, and glass.

Exposure to antimony at high levels can result in a variety of adverse health effects. Breathing high levels for a long time can irritate the eyes and lungs and can cause heart and lung problems, stomach pain, diarrhea, vomiting, and stomach ulcers. In short-term studies, animals that breathed very high levels of antimony died. Animals that breathed high levels had lung, heart, liver, and kidney damage. In long-term studies, animals that breathed very low levels of antimony had eye irritation, hair loss, lung damage, and heart problems. Problems with fertility also were noted. In animal studies, problems with fertility have been seen when rats breathed very high levels of antimony for a few months.

Ingesting large doses of antimony can cause vomiting. Any other effects that may be caused by antimony ingestion are unknown. Long-term animal studies have reported liver damage and blood changes when animals ingested antimony. Antimony can irritate the skin if left on it.

Antimony can have beneficial effects when used for medical reasons. It has been used as a medicine to treat people infected with parasites.

The DHHS, IARC, and EPA have not classified antimony as to its human carcinogenicity (13).

Exposure to antimony at this site from groundwater is unlikely. If antimony should enter the water supply, it would be diluted due to blending.

f. Beryllium

Beryllium is a hard, grayish metal naturally found in mineral rocks, coal, soil, and volcanic dust. Beryllium compounds are commercially mined, and the beryllium is purified for use in nuclear weapons and reactors, aircraft and space vehicle structures, instruments, x-ray machines, and mirrors. Beryllium ores are used to make specialty ceramics for electrical and high-technology applications. Beryllium alloys are used in automobiles, computers, sports equipment (golf clubs and bicycle frames), and dental bridges (14).
Swallowing beryllium has not been reported to cause effects in humans because very little beryllium is absorbed from the stomach and intestines. Ulcers have been seen in dogs ingesting

beryllium in the diet. Beryllium contact with skin that has been scraped or cut may cause rashes or ulcers.

DHHS and the IARC have determined that beryllium is a human carcinogen. EPA has determined that beryllium is a probable human carcinogen (14).

The level of beryllium found in the monitoring well, while above comparison values, was extremely low. Should beryllium enter the public water supply, it should not pose a health risk.

g. Cobalt

Cobalt is a naturally occurring element found in rocks, soil, water, plants, and animals. There are non-radioactive and radioactive forms of cobalt (15).

Non-radioactive cobalt, referred to as stable cobalt, is used to produce alloys (mixtures of metals) used in the manufacture of aircraft engines, magnets, grinding and cutting tools, artificial hip and knee joints. Cobalt compounds are also used to color glass, ceramics, and paints, and used as a drier for porcelain enamel and paints.

Cobalt has both beneficial and harmful effects on human health. Cobalt is beneficial for humans because it is part of vitamin B12.

Exposure to high levels of cobalt can result in lung and heart effects and dermatitis. Liver and kidney effects have also been observed in animals exposed to high levels of cobalt.

Exposure to large amounts of radioactive cobalt or the radiation it emits can damage cells in your body from the radiation. You might also experience acute radiation syndrome which includes nausea, vomiting, diarrhea, bleeding, coma, and even death

Non radioactive cobalt has not been found to cause cancer in humans or animals following exposure in food or water. Cancer has been shown, however, in animals who breathed cobalt or when cobalt was placed directly into the muscle or under the skin. Based on the laboratory animal data, IARC has determined that cobalt and cobalt compounds are possibly carcinogenic to humans.

Exposure to high levels of cobalt radiation can cause changes in the genetic materials within cells and may result in the development of some types of cancer (15).

Exposure to cobalt at this site from groundwater is unlikely. If antimony should enter the water supply, it would be diluted due to blending.

h. Copper

Copper occurs naturally at levels of approximately 50 ppm in the earth's crust. Levels at the CCP site vary up to 480 ppm in subsurface soil. Groundwater in the plume has levels up to 1600 ppb (16).

Potential for high exposure of the general population to copper may exist where people consume large amounts of tap water that has picked up copper from the distribution system. People living near copper smelters and refineries, and workers in these and other industries, may be exposed to high levels of copper in dust by inhalation and ingestion.

Copper levels were elevated in the soil at the CCP site, but no health guideline has been developed for copper. Estimates for exposure to copper in food range from 1-5 mg/day. Daily contact with copper in soil would result in exposures much less than those from copper commonly found in food, so adverse health effects are unlikely (16). Infrequent exposure to the soil on the site would make development of adverse health effects unlikely.

Copper was not detected in the public water supply wells above comparison values.

i. Di(2-ethylhexyl)phthalate

Di(2-ethylhexyl)phthalate (DEHP) is a manufactured chemical that is commonly added to plastics to make them flexible. DEHP is a colorless liquid with almost no odor (17).

DEHP is present in plastic products such as wall coverings, tablecloths, floor tiles, furniture upholstery, shower curtains, garden hoses, swimming pool liners, rainwear, baby pants, dolls, some toys, shoes, automobile upholstery and tops, packaging film and sheets, sheathing for wire and cable, medical tubing, and blood storage bags.

At the levels found in the environment, DEHP is not expected to cause harmful health effects in humans. Most of what we know about the health effects of DEHP comes from studies of rats and mice given high amounts of DEHP.

Harmful effects in animals generally occurred only with high amounts of DEHP or with prolonged exposures. Moreover, absorption and breakdown of DEHP in humans is different than in rats or mice, so the effects seen in rats and mice may not occur in humans.

Skin contact with products containing DEHP will probably cause no harmful effects because it cannot be taken up easily through the skin

DHHS has determined that DEHP may reasonably be anticipated to be a human carcinogen. The EPA has determined that DEHP is a probable human carcinogen. These determinations were based entirely on liver cancer in rats and mice. The IARC has stated that DEHP cannot be classified as to its carcinogenicity to humans (17).

The presence of DEHP in a monitoring well at the CCP does not pose a public health hazard.

j. Manganese

The manganese concentration in the shallow groundwater-monitoring wells was higher than that in the drinking water in towns in Greece, in which elderly (average age 67 years), long-term

residents (residence of 50 years or longer) displayed differences in various neurological signs from similarly-aged residents of a nearby town in which the water contained much less manganese. A child subject to pica behavior might ingest more manganese each day, weight for weight, from the soil on the property than did the villagers described above. No evidence has been found to connect manganese ingestion with cancer. Pica behavior typically does not last as long as the people in the Greek towns drank manganese-contaminated water, and a child of the age subject to pica behavior is not likely to be exposed to soil at this site. Manganese also is less readily absorbed from food or other solid material than from water (18-19).

Exposure to metals at levels of health concern at the CCP site is not likely.

k. Nickel

The most common harmful health effect of nickel in humans is an allergic reaction. Approximately 10-15% of the population is sensitive to nickel. People can become sensitive to nickel when jewelry or other objects containing nickel are in direct contact with the skin. Once a person is sensitized to nickel, further contact with the metal will produce a reaction. The most common reaction is a skin rash at the site of contact. The skin rash also may occur at a site on the body other than the site of contact. Less frequently, some people who are sensitive to nickel have asthma attacks following exposure to nickel. Some sensitized people react when they ingest nickel in food or water or breathe dust containing nickel (20).

DHHS has determined that nickel metal may reasonably be anticipated to be a carcinogen and that nickel compounds are known human carcinogens. IARC has determined that some nickel compounds are carcinogenic to humans and that metallic nickel may possibly be carcinogenic to humans. EPA has determined that nickel-refinery dust and nickel sulfide are human carcinogens (20).

Exposure to nickel at this site from either groundwater or subsurface soil is unlikely. Nickel was not detected in the public water supply wells.

Public Health Implications

Excavation workers at the RSA Energy Plant construction site in 1993 experienced an acute exposure to PCE and TCE in groundwater and subsurface soil. ADPH assumes that approximately 15 workers might have been involved in the excavation at the plant. The routes of exposure may have included inhalation, incidental ingestion, and dermal absorption. Inhalation would result when PCE and TCE, which are volatile organic compounds (VOCs), evaporate in the presence of air. Incidental ingestion would result from normal hand-to-mouth activities, like wiping the face or eating, drinking, or smoking with unwashed hands. Dermal absorption would result from contaminated groundwater or soil remaining on the skin throughout the work day. However, these exposures were not long-lived. No data are available to quantify individual employee's exposures during the removal and transport of contaminated soils. Based on the short exposure durations and the localized concentrations of contaminants, health risks during excavation likely were minimal.

Excavation workers employed at future construction sites in downtown Montgomery could potentially experience acute exposure to PCE and TCE in groundwater and subsurface soil. The number of workers exposed would depend upon the nature of the activity; therefore, no estimate of the number of people potentially exposed through this pathway is offered.

Workers using shallow groundwater for vehicle washing operations could potentially experience chronic (long-term) exposure to PCE and TCE. Several individuals have conducted washing activities daily for approximately 20 years. Others have been involved fewer than 15 years. The routes of exposure could include inhalation and dermal absorption. The 2002 well-sampling data do not show the presence of PCE or TCE above the health comparison value.

Because no MWWSSB wells are known to be currently affected by the CCP site, no current exposure to site contaminants is occurring. Customers of municipal water supplies from the MWWSSB blended-water system potentially could have experienced a past exposure to PCE from Well 9W. The routes of exposure could include ingestion, inhalation, and dermal absorption. However, because this is a blended water system with multiple wells, the concentration to which consumers would be exposed is likely to be greatly diluted. In addition, less than 5 percent of the total water volume of the Montgomery water supply generally is expected to come from the NWF in which Well 9W is located.

In the future, customers of the municipal water supply could potentially experience chronic exposure to PCE, TCE, and other VOCs if contaminants move downward into the deeper aquifer and affect the deep wells of the NWF. Approximately 224,420 customers receive water either directly from MWWSSB, from the Pintlala Water and Fire Protection Authority, or the Hunter Walk Manufactured Home Community. The future routes of exposure could include ingestion, inhalation, and dermal absorption. Ingestion would result from drinking and cooking with the water. Inhalation would result when PCE, TCE, or VOCs evaporate from shower spray or water left standing uncovered. Dermal absorption would result from bathing, showering, and washing activities. If the contaminant plume is left unchecked, customers could be exposed to PCE, TCE, and other VOCs in the future. However MWWSSB regularly tests all water to assure that contaminant levels are not above state and/or Federal Safe Water Standards.

If any households in the past used domestic wells from the shallow aquifer, people potentially could have experienced chronic exposure to PCE, TCE, and VOCs. ADPH has no information about the past existence of domestic wells. If wells were in use, the number of people exposed would have been limited to those living in particular households. No estimate of the number of people potentially exposed through this pathway is offered. No wells are currently in use and, therefore, no exposure is occurring.

ADPH considered the possibility that structures (either residential or commercial) contain a basement and are located in the area of the contaminated groundwater plume. Under this scenario, the potential exists for exposure to TCE or PCE via inhalation of vapors that migrate into basement air through the floor and walls. However, EPA has determined that the contaminated water is 50 feet bgs and that vapor intrusion is unlikely due to the depth of contaminated groundwater. It is doubtful that any adverse health effects have or will occur to

people that have inhaled or are inhaling the chemicals found in the basement air of their residences.

Community Health Concerns

By soliciting community health concerns, ADPH offers interested citizens an opportunity to participate in the public health assessment process. Interested citizens also can contribute information about activities at the site that improves the overall quality of the public health assessment. Community health concerns were recorded at public meetings, through telephone interviews, through interviews with ADEM and EPA officials, and through a community survey (Appendix C). The survey document was released for a public comment period and then finalized into the final survey document that was used.

Summary of Health Concerns and Responses

- *Is the plume contaminating our city drinking water supply? Could the contaminants have gotten into the water pipes and be in contact with water that comes through?*

  ADPH Response: All available information indicates that the water is safe to drink. ADPH has not yet been able to verify whether PCE-contaminated water from Well 9W, before it was removed from service, was introduced into the blended water system. If the water was not introduced into the system, ADPH has no reason to suggest that the city drinking water has been contaminated. If the contaminated water had been introduced into the city's blended water system, the contaminated water would have been mixed with water from other wells in the NWF, West Well Field, and the Tallapoosa River. That mixing would have diluted the concentration of PCE in the total volume of water to a much lower level. At this time, ADPH assumes the PCE level in total finished water would be far below the Maximum Contaminant Level of 5.0 ppb. Also, public water systems are required by law to notify customers if the water supply does not meet the EPA and/or Alabama Safe Drinking Water Standards.

- *I believe the plume could affect public health if the north well field is not relocated.*
  Response: Both the shallow and deep aquifers of the NWF are vulnerable. The quality of the shallow aquifer has already been compromised and two municipal wells have been taken out of service. As the plume migrates laterally in the shallow aquifer, other shallow wells could be compromised. The wells that draw water from the deep aquifer are vulnerable to vertical migration through openings in the clay confining layers at the sites of wells that have been improperly constructed or improperly abandoned.

- *I kept a list of employees in my building that developed cancer. I believe the plume could affect public health. Could my co-workers' cancers be connected to the plume?*

  Response: ADPH does not associate the employees' cancers to the CCP site for the following reasons:

- ADPH has not seen the list of cancers, but was told that the cancers were of various types. Cancers that develop because of exposure to hazardous substances are of particular types that are toxicologically related to the substance.

- The building in question is not located in areas described in any of the completed or potential exposure pathways described in the *Discussion* section above. The building drinking water is supplied by MWWSSB, and employees are not involved in excavation.

- *A clear sap-like material that smelled like old paint used to exude from the basement walls in the building where I worked. The problem was corrected after it was reported to the Health Inspector. Could female baldness and menstrual irregularities experienced by several workers be connected to the plume?*

  Response: The building manager reports that developers of the building in question were aware of contamination in the area because of the findings at the RSA Energy Plant site and the history of the building site prior to construction. For that reason, the building site was excavated and soil was replaced with clean fill [dirt?]prior to construction. That action eliminated the potential for hazardous substances to be present at the exterior of the basement walls. As a result of moisture leaking through the basement walls, corrections were made to the waterproofing on the exterior side. No information is available to suggest that female baldness and menstrual irregularities are connected to the contaminated groundwater plume.

- *Inhalation of vapors at low concentrations over many years could result in increased risk of developing cancer and non-cancer illnesses. Children who live, or attend school or day-care in the area[,] may be especially at risk. Women of childbearing age, especially those who become pregnant also may be at risk more than the rest of the population in the affected area.*

  Response: Contaminated water is approximately 50 feet below ground surface and vapor intrusion is unlikely at this site.

- *The EPA has declared the contaminants to be harmful to humans. My concern is that some construction project will pierce the soil barrier and permit the contaminated groundwater to get the surface.*

  Response: ADPH has made recommendations in this document to prevent future exposures for workers involved in excavations. ADPH also has made recommendations regarding the responsibility of employers to properly train their employees and to follow any applicable Occupational Safety and Health Administration (OSHA) guidelines. EPA has strict protocols for work to be done to prevent rupturing of barriers between layers of aquifers.

- *If there is no danger, why do you want to clean it up, especially if it will cost so much?*

Response: It is important to try to identify the source or sources, to determine whether any current releases are occurring, and to mitigate future groundwater problems. The quality of the shallow aquifer already is compromised for municipal, industrial, and domestic use. The deep aquifers are susceptible to downward migration through existing openings in the clay layers. The vulnerability of the NWF has the potential to affect the city's water system. Any clean-up activities will be designed to preclude future problems. Correction through remedial activities is more easily performed and less costly when the contamination is located in the shallower aquifers.

ATSDR Child Health Considerations

ATSDR recognizes that infants and children may be more sensitive to environmental exposure than adults. Because of this sensitivity, routes and means of exposure must be examined. Children potentially incur increased exposure to contaminants as a result of the following factors:

- Children are more likely to be exposed to outdoor media (e.g., air, soil, surface water) because children spend more time outdoors, and because they play and eat outdoors.
- Children are more likely to put unwashed hands in their mouth, or eat with unwashed hands.
- Some children deliberately eat non-food items, such as soil. This is called pica behavior.
- Children are shorter than adults, so they breathe more of the dust, soil, and vapors that are close to the ground.
- Children are smaller, so their exposure results in higher doses of contaminants in relation to their body weight.
- Children may sustain permanent damage if they are exposed to toxic chemicals during critical growth stages.

ADPH carefully evaluated whether children could come in contact with the contaminant plume. No current exposures to children are known. Past exposures at much diluted levels are possible, but, if such exposures did occur, no harmful health effects would be anticipated.

Conclusions

1. No municipal or residential wells currently in use are known to be contaminated, and no known exposure via drinking water is occurring. Therefore, ADPH concludes that the CCP site currently poses *No Apparent Public Health Hazard* to residents through drinking water.

2. In 1991 and 1992, water analyses from MWWSSB Well 9 W detected PCE levels above the MCL. ADPH understands that the well was taken out of service in 1992. Therefore, ADPH concludes that the CCP site represented *No Apparent Public Health Hazard* in the past. This is due to the quick removal of Well 9 W from service by MWWSSB and the dilution of any contaminants that might have been present by water in the Montgomery water supply's blended system.

3. If left unchecked and remedial activities are not completed, the contaminated plume could continue to migrate toward the NWF. Improperly constructed or improperly abandoned wells in the NWF might serve as conduits for water from the shallow aquifer to migrate downward into the deep aquifers. Therefore, ADPH concludes that left unaddressed, the CCP site represents an *Indeterminate Public Health Hazard* because of potential future exposures to contaminated groundwater.

4. In 1993, excavation workers at the RSA Energy Plant construction site experienced a completed acute exposure pathway to PCE and TCE in groundwater and subsurface soil. ADPH concludes that the CCP site represents a "no apparent public health hazard" to former workers since the duration of exposure was short. Business, real estate, and government professionals anticipate further downtown and riverfront development, thus creating the potential for future exposures for excavation workers. The CCP site represents an *Indeterminate Public Health Hazard* to future excavation workers since contaminant levels for those sites and exposure times are not yet known. The City of Montgomery has placed a moratorium on any future well drilling in the Site area.

5. Workers who use a shallow groundwater industrial well for daily vehicle washing operations could have been potentially exposed to PCE and TCE. ADPH is unaware of any health condition(s), among these workers, that could be associated with these contaminants ADPH concludes that the CCP site currently poses "no apparent public health hazard".

6. Contaminated groundwater is approximately 50 feet below the ground surface, and vapor intrusion is unlikely at this site. No known exposure via the air pathway is known at this time.

Recommendations

Take steps to prevent the potential future incorporation of contaminated water into the city water supply system.

Pre-excavation sampling should be conducted at future excavation sites to identify the presence of any contaminants. Workers employed at contaminated sites should have proper OSHA training and should follow applicable OSHA guidelines to prevent the possibility of exposure.

Periodic sampling of the EPA wells and the NWF should be continued to monitor the presence of contaminants. Regardless of whether contaminants are detected, the results should be forwarded to ADPH for evaluation and for inclusion into the site administrative record.

Public Health Action Plan

Actions Completed

ADPH participated in site planning meetings with the EPA and ADEM to coordinate public health activities with environmental activities. Earlier drafts of this public health assessment have been shared with EPA and ADEM.

ADPH attended meetings conducted by EPA and the City of Montgomery and conducted a community survey of all individuals who had expressed an interest or concern about the site.

Actions Planned

ADPH will request information from MWWSSB to verify the history of Well 9 W to determine whether PCE-contaminated water was incorporated into the municipal water supply prior to its being taken out of service. ADPH will also request information on procedures or mechanisms available to prevent water from contaminated wells from being incorporated into the water supply.

ADPH will continue to work with EPA and ADEM to review sampling data. Priority will be given to data recommended above to evaluate any exposures. A copy of this finalized public health assessment will be given to ADEM and EPA to ensure that site managers are aware of the need for actions to minimize the impact of the contaminant plume on the NWF.

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Certification

This Capital City Plume Public Health Assessment was prepared by the Alabama Department of Public Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). This public health assessment was conducted in accordance with approved methodology and procedures existing at the time the public health assessment was begun.

Technical Project Officer
Superfund Site Assessment Branch (SSAB)
Division of Health Assessment and Consultation (DHAC)
ATSDR

The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health assessment, and concurs with its findings.

Team Leader, Cooperative Agreement Team, SSAB, DHAC, ATSDR

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Appendix A. Tables

Table 1: Subsurface Soil (inorganic)

February 2002

Substance	Max. conc.	Location	Comp. Value	Reference
Inorganic	**mg/kg**		**ppm**	
Arsenic	26	SB-16	0.5	CREG
Chromium	33	SB-16	no value	
Lead	2,500	SB-16	no value	

mg/kg = micrograms per kilogram

ppm=parts per million

CREG – Cancer Risk Evaluation Guide

Table 2: Groundwater (organic)

Temporary / Permanent Wells

February 2002

Substance	Max. Conc.	Location	Comp. Value	Reference
Volatile Organics	**ug/L**		**ppb**	
Tetrachloroethene (tetrachloroethylene)	240	MW-12S	100	child RMEG
Semi-Volatile organics				
Bis(2-ethylhexyl)phthalate aka Di(2-ethylhexyl)phthalate	18	MW-12S	6	MCL

ug/L - micrograms per liter.

ppb – parts per billion.

child RMEG – Reference dose Media Evaluation Guide

MCL – Maximum Contaminant Level

Table 3. Groundwater (inorganic)

Temporary and Permanent Wells

February 2002

Substance	Max Conc.	Location	Comp. Value	Reference
Inorganic	**ug/L***		**ppb†**	
Antimony (dissolved)	5.5	MW-4I	4	Child RMEG ‡
Arsenic	36.	TW-15	0.02	CREG §
Arsenic (dissolved)	8.1	MW-4I	0.02	CREG
Beryllium	13	TW-15	4	MCL¶
Chromium	1,100	MW-12S	100	LTHA**
Cobalt	140	TW-15	100	Child int. EMEG
Copper	1,600	IW-01	300	Child int. EMEG
Lead	320	TW-16	0	MCLG??
Manganese	6,900	TW-15	500	Child RMEG
Manganese (dissolved	3,300	TW-16	500	Child RMEG
Nickel	740	MW-12S	100	LTHA

* ug/L (micrograms/liter)

† ppb-- parts per billion ,or milligrams/kilogram (mg/kg)

‡ Child RMEG - -

§ CREG Cancer Risk Evaluation Guide

¶ MCL - Maximum Concentration Level

** LTHA - Lifetime Health Advisory for drinking water (EPA)

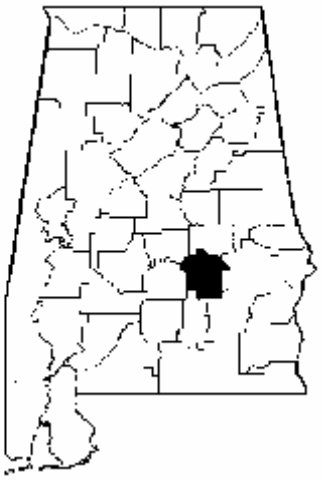
†† EMEG - Environmental Media Evaluation Guide

‡‡ MCL- Maximum Contaminant Level for drinking water (EPA)

§§ RMEG - Reference Dose Media Evaluation Guide

Appendix B: Figures

Figure 1. Site Location Map



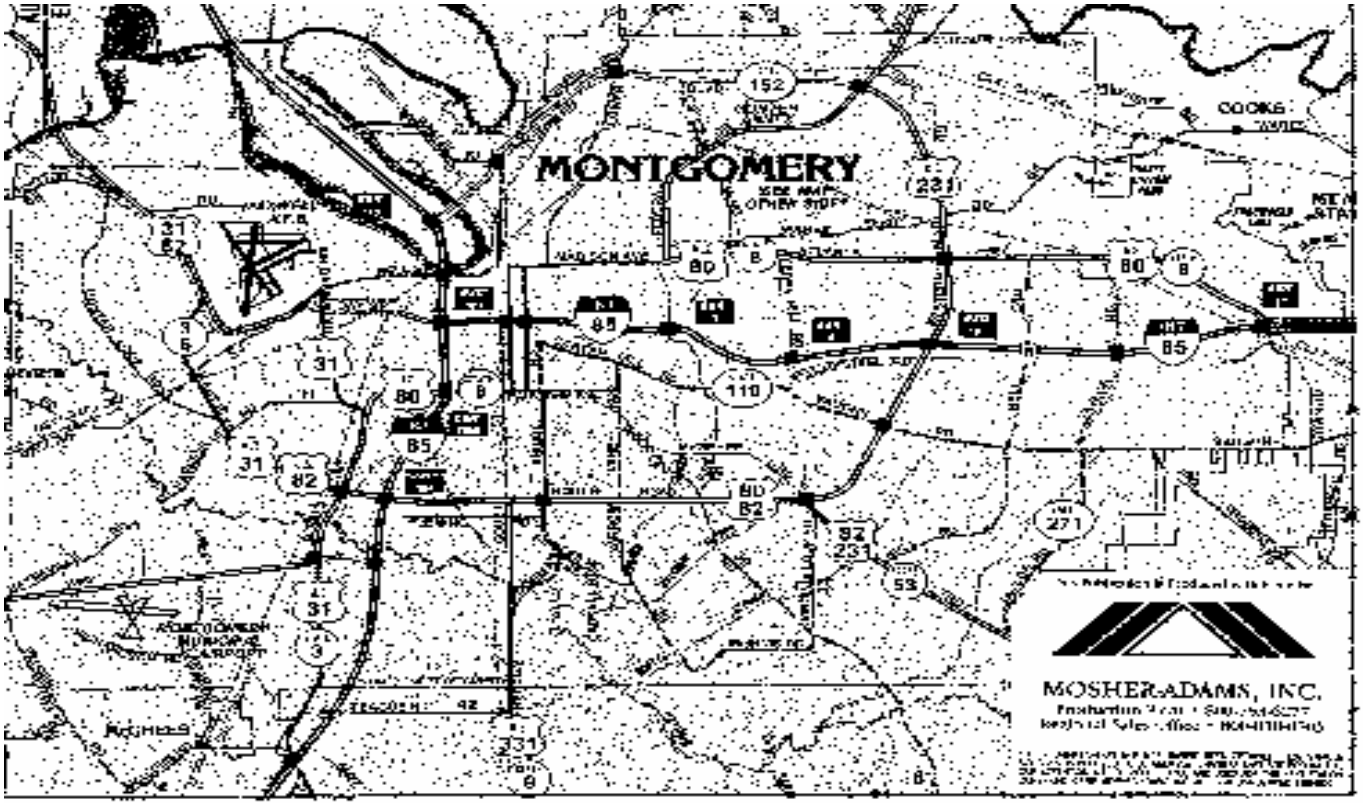


Figure 2: Groundwater Sample Location Map

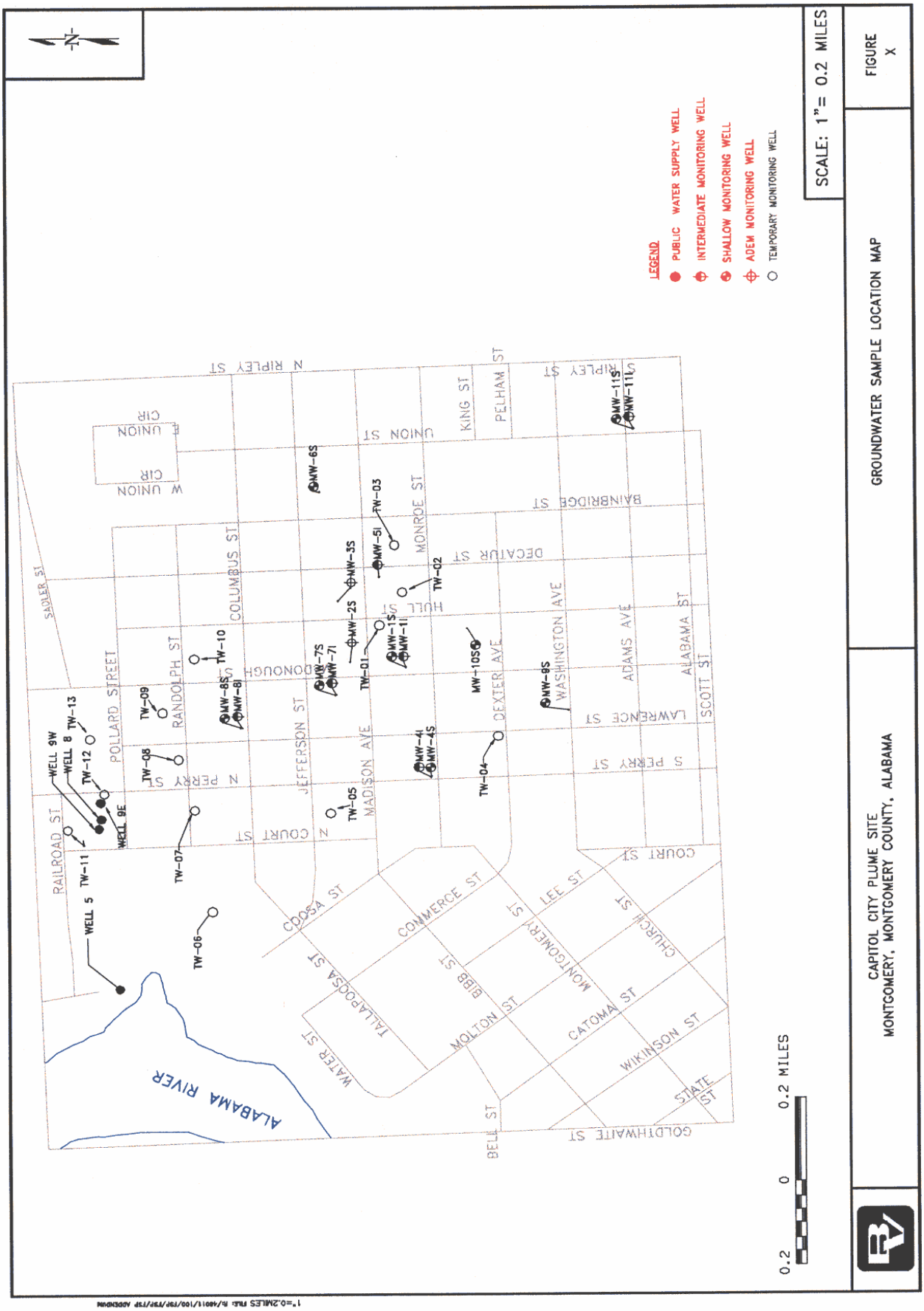


Figure 3. Area of Public Health Assessment

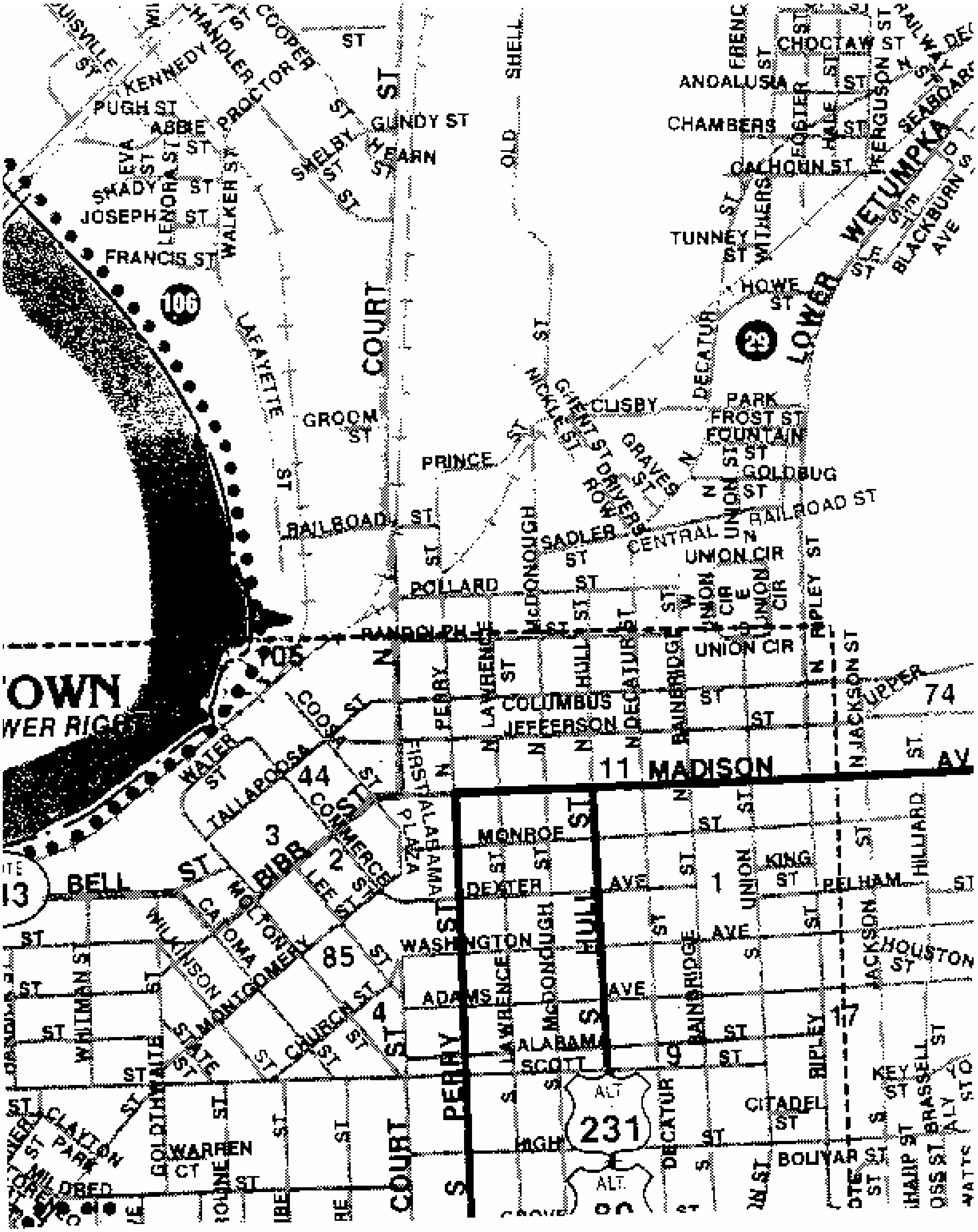

KENNEDY
CHANDLER
COOPER
PROCTOR
PUGH ST
ABBIE
EVA ST
SHADY ST
JOSEPH ST
LENORA ST
WALKER ST
FRANCIS ST
SHELBY ST
GUNDY ST
HEARN ST
COURT ST
OLD SHELL
106
LAFAYETTE ST
GROOM ST
PRINCE ST
RAILROAD ST
POLLARD
CHOCTAW ST
ANDALUSIA
CHAMBERS
FOSTER
HALE ST
FERGUSON
SEABOARD
CALHOUN ST
WITHERS
TUNNEY ST
WETUMPKA
LOWER
BLACKBURN AVE
HOWE ST
DECATUR
29
CLISBY
PARK
FROST ST
FOUNTAIN ST
GOLDBUG ST
GRAVES ST
DRIVERS ROW
NICKLE ST
McDONOUGH
SADLER ST
CENTRAL
UNION CIR
RIPLEY ST
RANDOLPH
UNION CIR
OWN
WER RIG
105
COOSA ST
N PERRY
LAWRENCE ST
COLUMBUS
JEFFERSON
HULL
N DECATUR
BAINBRIDGE
N JACKSON ST
UPPER
74
MADISON
AV
11
WATER ST
TALLAPOOSA
44
COMMERCE ST
3
BIBB
2
LEE ST
FIRST ALABAMA PLAZA
MONROE ST
DEXTER
AVE
KING
1
PELHAM
HILLIARD
BELL
13
MOLTON
CAHOMA
WILKINSON
WHITMAN ST
85
WASHINGTON
AVE
HOUSTON ST
ADAMS
4
MONTGOMERY
STATE
CHURCH ST
PERRY
ALABAMA
SCOTT
17
KEY ST
BRASSELL
CITADEL ST
ALT
231
HIGH
BOLIVAR ST
COURT
GOLDTHWAITE
CLAYTON
PARK
WARREN CT
MILDRED
DECATUR
ALT.

Figure 4: Plume Location (merged)

Appendix C: Community Survey

STATE OF ALABAMA DEPARTMENT OF
PUBLIC HEALTH
Donald E. Williamson, MD
State Health Officer

April 4, 2001

Dear Citizen:

This letter is addressed to people who are interested in the Capitol City Plume (CCP) site in Montgomery, Alabama. As you know, the CCP site is an area of contaminated groundwater under a small part of downtown Montgomery. For your reference, we have provided a news article with a map showing the area being investigated. Also, the U.S. Environmental Protection Agency has a brief description of the site and a newsletter available at http://www.epa.gov/region4/waste/npl/nplal/caplumal.htm. Other agencies that have been involved in the protection of drinking water supplies and environmental investigations are the Montgomery Water Works and Sanitary Sewer Board and the Alabama Department of Environmental Management.

The Alabama Department of Public Health is evaluating the site from a health perspective. We evaluate the results of environmental sampling data, plus input and concerns from the public. Our focus is whether the public could come in contact with the contaminants. All the information we have indicates that there is no public contact with contaminants. When our evaluation is complete, we report our conclusions and any recommendations to the public and other agencies. More information about this process is available at www.alapubhealth.org/risk/phap.htm.

To collect public input and concerns, we have provided a community survey by mail and online. If you would like to contribute input, please submit a completed survey by April 23, 2001. If you know of others who would like to reply, please share this opportunity.

If you have questions, please call me at 334-206-5973, or use our feedback page.

Sincerely,

Cheryl Browder
Public Health Educator
Risk Assessment & Toxicology Branch

The RSA Tower • 201 Monroe Street • Montgomery, AL 36104
P.O. Box 303017 • Montgomery, AL 36130-3017

Community Survey

Capitol City Plume, Montgomery, Alabama

Please submit the survey by April 23, 2001. Answers will be used to complete the public health assessment, record existing health concerns, and plan environmental health education. Completing the survey should take 5 minutes or less.

Part I: Knowledge of the site (check one answer for each question)

Approximately when did you first learn about the contamination?
____1990 - 1994 _____1995 - 1999 _____2000 - present

How did you first find out about it?
____Montgomery Water Works and Sanitary Sewer Board
____Alabama Department of Environmental Management
____U.S. Environmental Protection Agency
____City of Montgomery
____News media
____Alabama Department of Public Health
____Other:

How would you describe your level of knowledge about the contamination?
____Excellent
____Very good
____Fair
____Poor
____Very Poor

Part II: Living or working in the area of the plume
We have already received some questions or concerns about living and working within the plume investigation area. Answer these questions to tell us if you have concerns.

What is your connection to the plume investigation area: (check all that apply)
____Live in the area
____Work in the area
____Other:

Do you have questions or concerns about the following? (check all that apply)
____Private water wells
____Building foundations and basements
____Public drinking water supply
____Other:

List your questions or describe your concerns:

_____
_____
_____
_____
_____
_____

Do you believe the contamination could affect public health?
____Yes ____No

If yes, describe specific health concerns:

_____

_____
_____
_____

Part III: To receive public health information

If you want more information about any of the following topics, check all that apply.
____Description of contamination
____Potential for human exposure and actions to protect public health
____Progress of public health activities
____How to get more information about
_____
_____
_____
____Other:
_____

_____

How would you prefer to receive public health information? (check all that apply)
____News media ____E-mail
____U.S. Mail ____Alabama Department of Public Health web site
____Other:

What reading level is best for you? (check one)
____Less than 8th grade ____High school graduate
____8th grade - 12 grade ____Other:
Would you like to comment on the draft public health assessment for the Capitol City Plume site?
____Yes ____No

Contact information:

Name: _____
Address: _____
Telephone _____
E-Mail: _____

Thank you for your time and assistance.