Health Consultation

FIVE POINTS PCE PLUME

WOODS CROSS, DAVIS COUNTY, UTAH

EPA FACILITY ID: UTN000802654

DECEMBER 18, 2008

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:

Environmental Epidemiology Program
Office of Epidemiology
Utah Department of Health
Under a Cooperative Agreement with the
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SUMMARY

The Five Points PCE Plume in located about 11 miles north of Salt Lake City, in the city of Woods Cross, in Davis County, Utah. The contaminated groundwater plume is estimated to be approximately 5 acres in size. The primary contaminant in the ground water is tetrachloroethene (PCE), although 1,1-dichloroethane (1,1-DCA) and 1,1,1-trichloroethane (1,1,1-TCA) were also detected during the original sampling; however, there are other volatile organic chemicals (VOCs) that are degradation products of PCE and should thus also be considered as contaminants. These include trichloroethane (TCE), vinyl chloride (VC), cis- and trans-1,2-dichloroethene (cis- and trans-1,2-DCE), chloroethane, methylene chloride, 1,1,2,2-tetrachloroethane and benzene. The Five Points PCE plume site was proposed to the National Priorities List (NPL) in March 2007 and was finalized to the NPL in September 2007. Following the placement of the Five Points PCE plume site on the NPL, the Agency for Toxic Substances and Disease Registry (ATSDR) has requested that the Environmental Epidemiology Program (EEP) of the Utah Department of Health (UDOH) conduct this health consultation to identify the health hazards to the public posed by this plume.

As early as 1986, monitoring of municipal wells in the area detected PCE concentrations in the groundwater. A year later, an investigation was prompted in an attempt to identify the source of contamination in the area. Sufficient levels of PCE were also detected up-gradient of the monitoring wells to account for the contaminants identified in the 1986 sampling (UDEQ 1996).

Investigations conducted by the EPA and UDEQ confirmed the presence of PCE contamination in the groundwater in the Woods Cross area. PCE is a synthetic chemical used in a variety of industrial uses, most notably as a fabric cleaner in dry cleaning applications. TCE, used for metal degreasing purposes, is a degradation product of PCE. A point source for either the PCE or TCE contamination has not yet been identified. Other chemicals of potential concern to human health associated with these contaminants include: vinyl chloride (VC), cis- and trans-1,2-DCE, MTBE, and benzene. In the Woods Cross area, exposure to these chemicals is possible from drinking or using contaminated water from residential wells. Consumption and use of municipal drinking water is considered safe after the contaminated wells were taken offline following the detection of PCE in February 1999 by the city of Woods Cross. It is estimated that indoor air samples will be taken by DEQ in winter 2008 to determine if these contaminants affect indoor air quality. Other possible routes of exposure to these contaminants include ingestion, inhalation or skin contact with contaminated soils near the unknown source of contamination, inhalation of VOCs in the ambient air, and drinking from or swimming in irrigation canals that may contain contaminated groundwater.

EPA and UDEQ continue to investigate the site, monitor the extent of PCE contamination and are focused on both identifying the sources of contamination and determining remediation methods.

The EEP public health action plan, designed to mitigate and prevent adverse human health effects resulting from the exposure to hazardous substances in the environment from the Five Points PCE Plume, consists of evaluating the municipal drinking water supplies to ensure that remediation is complete and no plume contaminants are detected in the water supply. Soil,

water, and air samples will also be collected to determine the extent of contamination as well as to assess the appropriate remediation procedures. UDOH will also conduct a large public health educational campaign designed to disseminate information about the contaminants of concern to the community, address ways to reduce exposure to these contaminants, as well as potential health effects from exposure to these contaminants.

PURPOSE AND HEALTH ISSUES

The Agency for Toxic Substances and Disease Registry[1] (ATSDR) requested that the Environmental Epidemiology Program (EEP) of the Utah Department of Health (UDOH) conduct this public health consultation to identify public health hazards posed by the Five Points PCE Plume [EPA ID No. UTN000802654]. This site was proposed to the Environmental Protection Agency's (EPA) National Priorities List (NPL) on March 7, 2007.

The objective of a health consultation is to identify public health actions that should be taken to protect public health. Therefore the health consultation process is designed to complement remediation efforts at a site, but should not be confused with a risk assessment used for remedial design purposes. The purpose of this health consultation is to determine if the residents of Woods Cross, Davis County, Utah, are being exposed to tetrachloroethylene (PCE) and other volatile organic contaminants (VOCs) at levels of public health concern and to identify appropriate public health interventions. The Woods Cross community encompasses this PCE plume.

Due to the lack of current sampling data, EEP only examined all potential sources of human exposure to the contaminants of concern. When the necessary sampling data becomes available, this health consultation will be reexamined to include the relevant exposure dose data. EEP may also choose to conduct a public health assessment (PHA) if the necessary data become available. EEP will make conclusions on the public health concerns to the residents surrounding the Five Points PCE Plume and will make recommendations to protect the health of residents in the contamination area.

BACKGROUND

The UDOH has a cooperative agreement with ATSDR to address environmental health issues related to exposure from hazardous waste sites and other facilities in Utah. In an effort to respond to the Five Points PCE Plume site being proposed to the NPL, the EEP was asked to conduct a Health Consultation to determine the health hazards associated to the residents of Woods Cross from exposure to the plume.

[1] The 1986 Superfund Amendments and Reauthorization Act to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) directs ATSDR to perform specific public health activities associated with actual or potential exposures to hazardous substances released into the environment. Among those activities, ATSDR was mandated to perform a public health assessment for each site/facility either listed or proposed to be listed on the NPL within one year of the listing. In addition, ATSDR may conduct a public health assessment for a particular facility or release when petitioned by a person or group of persons.

The Five Points PCE Plume site consists of a groundwater plume contaminated with tetrachloroehtylene, also known as PCE. The plume is located near the intersection of 1500 South and State Highway 106 (Main Street) in Woods Cross, Davis County, Utah, a northern suburb of Salt Lake City. The site is bounded by residential and commercial properties and is located approximately two miles southeast of the Great Salt Lake and approximately one-half mile west of the Wasatch mountain range. Geographic coordinates of the area are 111° 53" 06" North latitude and 40° 52" 30" West longitude. Although the exact boundaries of the plume have not yet been delineated, characterization by data from permanent monitoring wells and the City of Woods Cross municipal supply wells has shown the plume to begin in Bountiful, traveling west-northwest into Woods Cross City, impacting the city's municipal well system. Most of the plume lies under Woods Cross City, making it the primary affected community (EPA 2007). The estimated area of plume contamination is shown in Figure 1, Appendix A. Figure 2, Appendix A shows the estimated affected area of both the Five Points PCE plume and the Bountiful 5th South PCE plume. The Bountiful 5th South PCE plume was included in this discussion due to the close proximity of the two plumes. Since the horizontal and vertical depth of the Five Points PCE plume still needs to be delineated, it is possible that the Five Points plume could conjoin with the previously established 5th South plume, creating a larger plume of contamination.

Tetrachloroethene (PCE) was detected in several wells near the site including two Woods Cross municipal supply wells (WC well # 1 and WC well # 2). The WC # 1 well was taken out of service in February 1999 due to PCE contamination detected at a concentration of 16.4 parts per billion (ppb). The EPA Maximum Contaminant Level (MCL) in drinking water for PCE is 5 ppb. Although the source of PCE has not been positively identified, WC well # 1 is located approximately 900 feet down gradient (west-northwest) of Your Valet Cleaners, a dry cleaning facility that uses PCE in its daily operations. Your Valley Cleaners, located at 1501 South Main Street, has been privately owned and operated since 1963.

Other potential sources of PCE include a former retail gasoline station/automotive garage and a former dry cleaner within the vicinity of the plume site (UDEQ 1998). The former retail gasoline station/automotive garage was located immediately south of Your Valley Cleaners at 1545 South Main Street, which is the present location of George West Quality Autos. According to the present property owner, underground storage tanks associated with the gas station were removed with no environmental impacts being identified. The former dry cleaning facility was located within the Five Points Mall area. The dates and duration of this facilities operation is unknown.

The Intermountain Waste Oil (IWO) site is also located in close proximity of the plume site, at 995 South 500 West, approximately 0.4 miles northwest of the plume site. The IWO site was proposed for addition to the National Priorities List (NPL) in 1999. PCE, 1,1-Dichloroethane (1,1-DCA) and 1,1,1-Trichloroethane (TCA) were contaminants detected in the groundwater at the IWO site. The site is both down gradient and cross gradient from the Five Points plume site.

The extent of the contaminated groundwater has not yet been determined. The vertical depth of the contamination is unknown as well. The PCE plume has not yet been completely delineated

and the investigation is still underway. Although no direct source has been identified, the contamination is thought to be from one or more dry cleaning businesses in the area. The EPA has been working with a dry cleaning facility in the contamination area to remove old underground storage structures containing PCE (EPA 2007). This, however, will only partially address the source(s) and will not address the contaminated groundwater plume. The city of Woods Cross cannot address the contamination because of the cost and technical complexity of the problem.

The region is characterized by a semi-arid climate, with temperature fluctuations of up to 100°F between winter and summer months. Wind patterns for the region vary according to season and location of storm fronts. The average precipitation is 13 to 15 inches, with a 24-hour maximum rainfall of 2.15 inches. The land surface slopes slightly to the northwest (UDEQ 1999).

The site is on the southern portion of the primarily confined East Shore Aquifer system. The East Shore Aquifer system consists of three artesian aquifers: shallow (60-250 feet below ground (bgs)), intermediate (250-500 feet bgs), and deep (greater than 500 feet bgs). The primary recharge area is nearest to the mountain front, which is underlain mainly by permeable sands and gravel that enhance the recharge water movement. These aquifers are hydraulically connected; however, little work has been conducted to define the boundaries between them. The shallow and deep aquifers likely conjoin into a single aquifer in the recharge area, which lies less than half a mile east of the site. These aquifer systems are composed of mudflow deposits that are poorly sorted and only slightly permeable (UDEQ 1999).

The Wasatch front is the west face of the Wasatch Mountain Range located a few miles east of Woods Cross and runs north-south through the northern part of Utah. To the west of Woods Cross is the Great Salt Lake. Groundwater flow direction along the Wasatch front is generally in the direction of the Great Salt Lake. In the Bountiful/Woods Cross area, the flow is generally from the east–southeast towards the west (EPA 2004a). Groundwater investigations at the Woods Cross Refinery indicate that groundwater flows in a northwest direction (Clark 1991; Anderson et al. 1994). Groundwater west of the site is near or at the ground surface (UDEQ 1999). Surface water in the area consists of irrigation canals.

Several residential wells in the area are completed in the shallow aquifer. Currently, this aquifer is not believed to be a primary drinking water source but, historically, has been used for industrial and irrigation purposes (Clark 1991; Anderson et al. 1994). The shallow aquifer is classified by the State of Utah as a Class II drinking water source (drinking water quality groundwater). Although it is believed that the residential wells are currently used mainly for irrigation, it is possible (and has been reported), that current and future residents may use the water for drinking and other domestic purposes (EPA 2004a). Several residential wells used for irrigation discharge water into the nearby canals (UDEQ 1996).

Land Use and Demographics

The Five Points PCE Plume is located in the city of Woods Cross, in Davis County, Utah. The site contains residential, commercial, industrial, and agricultural areas, including a shopping center and the Woods Cross Refinery. The refinery employs approximately 140 people (Salt Lake Tribune 2003); it is not known how many additional employees may work in the plume area.

According to 2000 U.S. Census Bureau data, 3,334 people, mainly in the city of Woods Cross, live within one mile of the site. Of those residents, 332 are children age four and under, and 1,029 under 19 years of age. Residents who live near the plume are a predominately white population with less than three percent having Asian, African American, or Hispanic backgrounds. The average household size in the area is 3.32 persons per household (USCB 2000).

The number of people residing in Woods Cross has increased approximately 10 percent from the population reported in the 1990 Census Bureau data. The current population of Woods Cross is 6,419. The total estimated population of Davis County is 238,997 (USCB 2000).

Site History

The city of Woods Cross utilizes four municipal water wells to provide drinking water to the approximately 7,400 residents that reside within the city limits. Two of these wells (Woods Cross well # 1 and Woods Cross well # 2) are currently contaminated with PCE. One of these contaminated wells has consistently detected concentrations of PCE greater than the Cancer Risk Screening Concentration (CRSC) and the federally regulated Maximum Contaminant Level (MCL). This well provides over 33% of the city's water supply to its residents. The sampling trend over time for this well shows an increase in PCE concentrations. Due to the increase in PCE concentrations, this well was removed in February 1999 as the primary source of drinking water to the city and has remained offline for nine years.

The other contaminated well is routinely monitored for contaminants and has tested positive for PCE, however, the levels are below those regulated under the safe drinking water standards and the well has not been taken offline. The current safe drinking water standard for PCE is 5 parts per billion (ppb).

Municipal Well Sampling

From September through November 1998, the Utah Department of Environmental Quality (UDEQ) was charged by the EPA with performing well sampling in the Five Points area. This sampling included the installation of two monitoring wells, the sampling of three other monitoring wells installed in September 1998, and the sampling of three existing ground water wells, two of which were used for potable water by the city of Woods Cross. Of the eight wells initially sampled, two wells were quantified as non-detect (not having any detectable concentrations of PCE); the remaining six wells were found to contain concentrations of PCE ranging from 1.4 to 310 µg/L.

A sampling event performed by URS Operating Services, Inc. (UOS) at the request of EPA in November 1999 conducted the initial sampling, detecting PCE in two Woods Cross municipal water supply wells (designated Woods Cross well # 1 and Woods Cross well # 2). The Woods Cross well # 1 is located near the intersection of 1500 South and State Highway 106, and had a depth of approximately 334 feet when it was originally drilled in 1936. Previous laboratory data from samples collected from these wells from 1989 until 1999 show that PCE was first detected in April 1995. Records from the city of Woods Cross document contamination of PCE in the wells dating back to 1988. In the 1999 investigation, Woods Cross well # 1 contained PCE concentrations from 4.0 micrograms per liter (µg/L) to 16.4 µg/L. Due to the high

concentrations of PCE detected during sampling, well # 1 was taken out of service in February 1999.

The Woods Cross # 2 well, located near the intersection of 1500 South and 700 West, is approximately 4,300 feet due west of Your Valley Cleaners. This well was drilled in 1953 to a depth of 252 feet. PCE was first detected in December 1988. In 1999, a concentration of 5.7 ppb PCE was detected, which was the highest concentration reported for Woods Cross well # 2 during the period for which results are available. The Woods Cross well # 2 was taken out of service on September 1, 1999. PCE is the only VOC that has been detected in either municipal well.

Monitor Well and Groundwater Sampling

Five monitor wells installed by UDEQ in September 1998 were sampled using a Grundfos Rediflow submersible pump. The wells were sampled beginning with the background well, which was expected to contain the lowest VOC concentrations. The Mall # 1 well, in closest proximity to the plume and therefore expected to have the highest VOC concentrations, was sampled last. The design of the sampling method allowed the same submersible pump to be used for all wells, improving both the accuracy and precision of the results obtained. Static water level and total depth were measured with a water level indicator in each well. The five wells were first purged of three casing volumes of the water column prior to sampling. Total depth, static water depth, temperature, pH, and conductivity measurements of the water recovered after purging was completed were recorded for each well.

UDEQ, under the authority of EPA, was asked to perform a site inspection for the Five Points PCE Plume site that included the sampling of four ground water wells. This sampling occurred on September 11, 2006, and resulted in the detection of PCE in Woods Cross wells # 1 and # 2 as well as two monitored wells (MW-1 and MW-2) down-gradient of the Five Points Mall. It should be noted that the two wells mentioned above were the only wells that were intact and thus could be sampled. Two wells associated with the study were found to be dry (B5P-MW-1 and mall well # 1) and two others had been destroyed by construction (mall well # 2 and mall well # 3). The concentrations of PCE in the sampled wells ranged from 1.8 μg/L to 24 μg/L.

Four wells were sampled during this process. Two represented municipal waters (B5P-MW-1 and B5P-MW-2) and two represented monitoring wells (B5P-MW-3 and B5P-MW-4). Concentrations of PCE were detected in the four wells sampled; higher PCE concentrations than the MCL were only measured in two wells, one municipal (B5P-MW-1) and one monitoring (B5P-MW-3). TCE and MTBE were also measured in the samples from B5P-MW-3, although their concentrations did not exceed MCL values, which are shown in Appendix A, Table 1. TCE is commonly known as degradation product of PCE and therefore show a breakdown of the parent compound over time. From this data, it is plausible that the PCE is changing into other potentially more toxic contaminants.

Groundwater Sampling

UDEQ, under the authority of EPA, was asked to perform a site inspection for the Five Points PCE Plume site that included the sampling of four ground water wells. This sampling occurred

on September 11, 2006, and resulted in the detection of PCE in Woods Cross wells # 1 and # 2 as well as two monitored wells (MW-1 and MW-2) down-gradient of the Five Points Mall. It should be noted that of the four wells mentioned above were the only wells that were intact and thus could be sampled. Two wells associated with the study were found to be dry (B5P-MW-1 and mall well # 3) and two others had been destroyed by construction (mall well # 2 and mall well # 3). The concentrations of PCE in the sampled wells ranged from 1.8 μg/L to 24 μg/L. This corresponds to a past exposure level of between 0.05-0.7 ug/L for adult exposure to PCE and 0.11-1.5 ug/L exposure level for children. The higher concentrations for both children and adults result in a dose that is equal to or exceeds the carcinogenic comparison values for PCE. Therefore, a more current sampling of the groundwater is needed to not only verify the concentrations of PCE but also determine if the concentrations are increasing, decreasing, or remaining constant in order to effectively determine health effects.

Soil Sampling

In 2003, additional sampling was performed by UOS and EPA which centered on investigating the presence of soil contamination within the plume area. Subsurface soil sampling was performed concurrently with the construction of a parking garage for the Five Points Mall, which is directly adjacent to the plume. Sampling of several properties in the immediate area of the plume as well as the collection of a ground water sample occurred. The sampling resulted in the presence of PCE in soils, but a vertical limit of contamination could not be quantified from the results. More comprehensive information will be derived from ground water well sampling that is to be performed by UDEQ in the summer and fall of 2008.

DISCUSSION

Nature and Extent of Contamination

Chemicals detected during the initial sampling of the Five Points PCE Plume site include PCE, 1,1-dichloroethane (1,1-DCA), and 1,1,1-trichloroethane (1,1,1-TCA). Possible sources of these contaminant types include businesses that routinely use solvents as cleaning agents. Dry cleaners, automotive and machinery shops, and facilities with waste oil tanks (often inappropriately used to contain solvents) are among the most likely sources for this type of contamination. Migration routes for contaminants include spills, leaks from containers, and leaks from sewer lines.

Although these contaminants are of primary concern due to their detected presence in the plume area, there are additional contaminants that are known degradation products of these compounds that also need to be considered. These compounds include trichloroethylene (TCE), *cis*- and *trans*-1,2-dichloroethylene (1,2-DCE), methylene chloride, chloroethane, 1,1,2,2-tetrachloroethane, vinyl chloride (VC), benzene, chloroethane, and 1,1,2,2-tetrachloroethane (Grostern and Edwards 2006; Kohn and Roberts 2006). Sampling in all environmental media should also focus on the presence of these chemicals.

Detections of PCE and TCE in the municipal wells at the city of Woods Cross were first noted in 1986. Ten years later, in 1996, EPA conducted sampling of residential and monitoring wells located

down- and cross-gradient of the contaminated monitoring wells. Four residential wells on-site were determined to contain elevated levels of PCE. Low levels of PCE contamination have been detected in other residential wells on-site. Of the three municipal wells operating within a quarter of a mile of the site, one has been inactivated because of PCE contamination.

EPA and UDEQ have since conducted numerous investigations to identify potential sources of contamination. Subsurface soil gas sampling will be performed in an attempt to delineate the nature and extent of the contamination (EPA 2001).

Exposure Pathways Analysis

To determine if nearby residents, visitors, and workers are exposed to contaminants related to a site, ATSDR evaluates the environmental and human components that lead to human exposure. An exposure pathway consists of five elements (ATSDR 2005):

(1) A source of contamination;
(2) Transport through an environmental medium;
(3) A point of exposure;
(4) A route of human exposure; and
(5) A receptor population.

ATSDR categorizes an exposure pathway as either *completed, potential, or eliminated*. In a *completed* exposure pathway, all five elements exist and indicate that exposure to a contaminant has occurred in the past, is occurring, or will occur in the future. In a *potential* exposure pathway, at least one of the five elements has not been confirmed, but it may exist. Exposure to a contaminant may have occurred in the past, may be occurring, or may occur in the future. An exposure pathway can be *eliminated* if at least one of the five elements is missing and will never be present (ATSDR 2005).

When an exposure pathway is identified, comparison values (CVs) for air, soil, or drinking water are used as guidelines for selecting contaminants that require further evaluation (ATSDR 2005). To protect susceptible populations, the CVs for children are used when available.

The main route of exposure identified at the Five Points PCE Plume is the groundwater pathway. Insufficient sampling of soil, air, and surface water at the plume site make it difficult to quantify or eliminate any additional pathways of exposure. Once the sampling of these media is completed, the additional exposure pathways will be better assessed as to the potential hazard each poses to the affected community.

Completed Exposure Pathways

Residential Wells: past, present, and future exposure

At the Five Points PCE Plume site, exposure to contaminated groundwater occurred in the past when PCE was identified in two municipal wells. The timeline for resident exposure is unknown; exposure would depend on the amount of water used and the concentrations of contaminants in each specific municipal or residential well prior to the detection of the contaminant in municipal wells and the

well being taken offline. Although the municipal well was not used following the detection of PCE, residential wells would have still been in operation, resulting in a higher exposure to those residents using residential wells. Using this information, all five elements have existed in the past and may currently exist for the residents using water from residential wells in the plume area that may have PCE contamination:

Exposure element	Five Points PCE Plume
1) A source of contamination……....	PCE plume site
2) Transport through environmental medium...	groundwater from municipal/residential wells
3) A point of exposure……..	faucets from homes and businesses receiving water from municipal/residential wells
4) A route of human exposure……..….	ingestion, skin contact, and inhalation
5) A receptor population……...	residents and workers in affected area

Current and future exposure to PCE may occur in an unknown number of homes with residential wells that have either not been connected to municipal water and/or those that reportedly use the wells as a primary source of drinking water. Additional sampling would be needed to determine the number of residents in the affected area using wells as a primary source of water. Once these residents have been identified, a filter could be installed in the homes to reduce the residents' current exposure, but future exposure would be possible if the filter was not maintained, or if the filter was removed.

Estimated exposure doses and the health effects associated with exposure to PCE and other contaminants will be discussed in the "Exposure Dose Estimates and Toxicologic Evaluation" section of this document.

Indoor Air

Groundwater contaminants can volatilize, migrate via soil gas, and enter indoor air. Therefore, if there is enough soil gas contamination, (which is possible if a spill occurred at the source), the indoor air near the site of the release could become contaminated with VOCs. Nearby residents and workers may be exposed by breathing the air.

Although it has not currently occurred, limited indoor air and sub-slab air sampling would need to be conducted in an attempt to define the scope of contamination. Contaminants such as PCE, TCE, cis- and trans-1,2-dichloroethylene and vinyl chloride should be sampled and monitored to determine if air contamination exists. Workers at businesses and residents in homes are at risk for air contamination from these compounds if they are present in indoor air.

Exposure element	Five Points PCE Plume
1) A source of contamination……	PCE plume site
2) Transport through environmental medium…	groundwater/vapor intrusion
3) A point of exposure.....	residential wells
4) A route of human exposure.....	inhalation
5) A receptor population.....	residents

Potential Exposure Pathways

Ambient Air

When soil gas reaches the ground surface, the contaminants will pass into the ambient (outdoor) air. Therefore, if there is enough soil gas contamination, (which is possible if a spill occurred at the source), the outdoor air near the site of the release could become contaminated with VOCs. Nearby residents and workers may be exposed by breathing ambient outdoor air.

Although no sampling has occurred as of yet, subsurface soil gas sampling will need to be conducted in an attempt to define the scope of contamination. If sufficient levels of PCE or its derivatives are present, it is plausible that ambient air contamination exists. Therefore, without further sampling data only two elements of this pathway have been confirmed, 1) the source of contamination (contamination in the outdoor air from the PCE plume) and 2) its transport through an environmental medium (air); however, the other three elements may exist in the future following adequate sampling being conducted.

Exposure element	Five Points PCE Plume
1) A source of contamination	PCE plume site
2) Transport through environmental medium	ambient air
3) A point of exposure	unknown at present
4) A route of human exposure	unknown at present
5) A receptor population	unknown at present

Soil

Currently, no soil sampling has been conducted at this site, therefore it not possible to fully evaluate this pathway. Two pathway elements currently exist for soil, 1) the source of contamination (contamination in the soil from the PCE plume site) and 2) its transport through an environmental medium (soil); however, upon the completion of appropriate soil sampling in the area of the PCE plume the additional three exposure elements may exist in the future.

Exposure element	Five Points PCE Plume
1) A source of contamination	PCE plume site
2) Transport through environmental medium	soil
3) A point of exposure	unknown at present
4) A route of human exposure	unknown at present
5) A receptor population	unknown at present

Adequate soil sampling will quantify levels of contaminants in the soil. If the chemical concentrations detected are below ATSDR's soil CVs, because the source of contamination is presently unknown, it is possible that the volume released at the source(s) be significant enough to travel a great distance to reach the groundwater, and therefore contaminating soils at the source and below. Contaminated soils could present a risk to residents and workers near the source(s) of contamination.

Surface Water

Potential exposures from the surface water pathway cannot be evaluated because no surface water samples have been collected. Migration of potentially contaminated groundwater to surface water is possible; however, because water from several of the irrigation wells flows into nearby surface water canals. A route of human exposure and the exposed population has not been observed, but may include children playing in the canals during the summer months. This exposure pathway will need to be re-evaluated once adequate sampling data exists to determine if its exposure has changed.

Exposure element	Five Points PCE Plume
1) A source of contamination	unknown at present
2) Transport through environmental medium	unknown at present
3) A point of exposure	unknown at present
4) A route of human exposure	unknown at present
5) A receptor population	unknown at present

Public Health Implications

Levels of contaminants that exceed comparison values will not necessarily cause adverse health effects upon exposure. The potential for exposed persons to experience adverse health effects depends on many factors, including:

(1) The amount of each chemical to which a person is or has been exposed;
(2) How long a person is exposed;
(3) The route by which a person is exposed (inhalation, ingestion, or dermal absorption);
(4) The health condition of the person;
(5) The nutritional status of the person; and
(6) Exposure to other chemicals (such as cigarette smoke or chemicals in the work place).

The public health implications of the PCE contamination at the site will be better understood following adequate environmental sampling of the area.

Evaluation Process

Upon appropriate sampling of the Five Points PCE site, EEP will examine the types and concentrations of each chemical of concern for each media type (soil, groundwater, etc.) in which the chemical was measured. ATSDR and EPA comparison values will then be used to screen for chemicals of concern that would warrant further evaluation for a possible risk to human health. Comparison values (CVs) are media-specific concentrations of contaminants that can be reasonably assumed to be harmless when assuming default conditions of exposure. CVs are generally conservative concentrations used to ensure the protection of sensitive populations, most notably pregnant women and developing children. Values of contaminants that exceed the CVs do not indicate that a health risk exists; it merely indicates that further evaluation is required for these chemicals.

Exposure Dose Estimates and Toxicological Evaluation

The primary chemical of concern for the Five Points plume site is PCE; however, there are a variety of other chemicals that can occur as a result of the breakdown of PCE over time. These include

TCE, benzene, chloroethane, cis-1,2-DCE, methylene chloride, 1,1,2,2-tetrachloroethane, and vinyl chloride. If these chemicals are present at concentrations that may be of potential health concern for adults and children residing or working in the area, then appropriate actions to protect human health needs to be taken. As previously discussed, ingestion of water contaminated by PCE occurred in the past and may presently be occurring. Exposure doses for children and adults will be calculated and discussed after sufficient current sampling data has been acquired.

For present and future exposure, ingestion of groundwater from contaminated residential wells is the most likely exposure pathway. Other potential exposure pathways include soil or surface water ingestion, inhalation of ambient air or dust, and skin contact with soil or surface water. Because no sampling data are currently available, no specific pathway can be completely assessed. When this data does become available, EEP will use the most recent analytical data in addition to previously collected data (UDEQ 1996, URS 1996a, URS 1996b, URS 1996c, URS 1997, Golder 1987, UDEQ 1998, UDEQ 1999, CDM 2002, CDM 2005a, CDM 2005b, HDR 2003) to evaluate exposure doses in a revised public health assessment.

If a contaminant exceeds the CVs, then it will undergo further toxicological evaluation. A site-specific exposure dose will be calculated for both adults and children for each contaminant that exceeds a media-specific CV. These calculated exposure doses were then compared to an appropriate health guideline. These guidelines are conservative health-protective values that have been developed using human exposure data when it is available from scientific literature. When human data is not available, animal exposure data is used. Health guidelines used in this report include ATSDR's Minimal Risk Levels (MRLs) and EPA's Reference Doses (RfDs). Exposure doses that are lower than the MRL or RfD are considered to be without appreciable risk to human health. When a calculated exposure dose exceeds the health guideline, the exposure dose is then compared to values from individual studies documented in scientific literature that have reported health effects. These values may be No Observable Adverse Effect Levels (NOAEL) or Lowest Observable Adverse Effect Levels (LOAEL). If a contaminant has been determined by the scientific literature to be cancer causing (carcinogenic), a cancer risk is also estimated (ATSDR 2005). The calculations for determining exposure dose for oral ingestion can be found in Appendix B.

Tetrachloroethene (PCE)

PCE has many names. Among these are tetrachloroethylene, perchloroethylene, perc, perclene, and perchlor. PCE is a synthetic chemical that is widely used for dry cleaning of fabrics and metal-degreasing, as well as other industrial uses (ATSDR 1997a). Exposure to PCE can occur by using certain consumer products. Examples include spot removers, adhesives, wood cleaners, and water repellents.

Exposure to PCE occurred in the past when residents were drinking water from municipal and residential wells contaminated with PCE prior to the municipal wells being taken offline. Exposure doses will be calculated for both children and adults and compared to ATSDR's Minimal Risk Levels (MRLs). The MRL is considered an estimate of the daily human oral exposure to PCE that is likely to be without appreciable risk of adverse non-cancer health effects. This number is based on studies performed with laboratory mice for 60 days where changes in behavior were observed at 5 mg/kg/day (Fredriksson et al. 1993). Due to the fact that past sampling data is not complete and sufficient enough to base exposure concentrations, the PCE concentrations found in the current

sampling of the municipal wells and groundwater in the area will be evaluated against the MRL and an oral exposure dose indicative of current concentrations will be calculated.

The exposure dose for residents exposed to PCE through municipal water supplies was calculated to be 6.86×10^{-4} mg/kg/day for adults and 1.5×10^{-3} mg/kg/day for children. Both of these exposure doses are below the Maximum Risk Level (MRL) for PCE, which is set at 0.05 mg/kg/day; therefore, no adverse health hazard are likely for residents consuming this water at PCE concentrations measured in the past.

Despite the identification of the MRL, the human health effects of drinking water with low levels of PCE are not definitively known. The effects of exposing infants to PCE through breast milk are unknown. PCE has been used as a general anesthetic agent and at high concentrations can cause dizziness, amnesia, and loss of consciousness. PCE has also been used to treat hookworm and other intestinal worms (ATSDR 1997a).

The EPA is currently reviewing the carcinogenicity of PCE. A cancer slope factor for PCE is not currently available and therefore, a theoretical cancer risk for this chemical cannot be determined. The International Agency for Research on Cancer (IARC) has determined that, based on limited human evidence and sufficient evidence in animals, PCE probably causes cancer in humans. The National Toxicology Program (NTP) identifies PCE as "reasonably anticipated to be a carcinogen" (ATSDR 2004a).

An investigation of cancer incidence in the Bountiful/Wood Cross area did not find any cancer types associated with PCE exposure that was statistically significantly increasing in the Bountiful/Wood Cross area as compared to the state of Utah from 1978–2001 (ATSDR 2004b).

Trichloroethene (TCE)

TCE (also called trichloroethylene, Triclene®, or Vitran®) is a non-flammable, colorless liquid with a sweet taste. It has a sweet odor that is noticeable beginning at a level of about 100 ppm. The largest source of trichloroethene (TCE) in the environment is evaporation from factories that use TCE as a solvent to remove grease from metals. TCE can also be found many products used everyday, including typewriter correction fluid, paint removers, and adhesives. When TCE is released into groundwater, degradation or breakdown becomes difficult due to less opportunity for evaporation (ATSDR 1997b).

Human exposure to TCE occurs through drinking or bathing in contaminated water. When a person drinks water that contains TCE, the majority of the contaminant is absorbed directly into the bloodstream. Once TCE is in the body, the liver converts it to other chemicals that are excreted in the urine within a day. If exposure continues, TCE and its breakdown products can build up in body fat (ATSDR 1997b).

The EPA established the MCL of TCE that is permissible in community water systems at 5 ppb. Some studies in humans exposed to TCE in drinking water reported impaired fetal development in pregnant women (ATSDR 1997b). A New Jersey survey suggested an association between TCE exposure at levels averaging about 55 ppb in water (level >10 ppb) to oral clefts, central nervous system defects, neural tube defects, and major cardiac defects (ATSDR 1997b). Interpretation of the

findings of that study was limited by the small case numbers and exposure classification.

Exposure doses for ingesting groundwater contaminated with TCE at the highest concentration detected during sampling will be estimated for children and adults. Based on the highest concentration of TCE measured during sampling (0.44 μg/L), exposure doses for both adults and children were calculated at 1.26×10^{-5} mg/kg/day and 2.75×10^{-5} mg/kg/day, respectively. The MRL for TCE is 0.2 mg/kg/day. Therefore, due to the fact that the exposure doses are well below the MRL value, it can be determined that no adverse health effects are likely at the TCE concentrations found in past groundwater samples.

The IARC has determined that, based on limited human evidence and sufficient animal evidence, TCE probably causes cancer in humans (ATSDR 2004a). The EPA classifies TCE as a probable human carcinogen; the NTP has established that TCE is reasonably anticipated to be a carcinogen. However, more research is needed to establish the relationship between TCE exposure and cancer.

The previous cancer assessment for TCE has been withdrawn and is currently under review, therefore the cancer risk from exposure to TCE is unknown (EPA 2006a). An investigation of cancer incidence in the Bountiful/Wood Cross area did not find any cancer types associated with TCE exposure that was statistically significantly increasing in the Bountiful/Wood Cross area as compared to the state of Utah from 1978–2001 (ATSDR 2004b).

Methyl Tert-Butyl Ether (MTBE)

MTBE is the common name for a synthetic chemical called methyl tert-butyl ether. It is a flammable liquid made from combinations of chemicals like isobutylene and methanol. It has a distinctive odor that most people find disagreeable. It was first introduced as an additive for unleaded gasoline in the 1980s to enhance octane ratings. MTBE is an oxygenating agent that enables fuel to burn more efficiently during the winter months. When MTBE is mixed with gasoline, people can come in contact with it if exposed to automobile fuel vapors or exhausts. MTBE has other special uses as a laboratory chemical and in medicine to dissolve gallstones (ATSDR 1996b).

MTBE will evaporate quickly from open containers. In the open air, it will quickly break down into other chemical compounds, with half of it disappearing in about four hours. Like most ethers and alcohols, MTBE dissolves readily in water. If MTBE is spilled on the ground, rainwater can dissolve it and carry it through the soil into the groundwater. Spills or leaks from storage containers can seep into deeper soil layers and pollute groundwater, especially near manufacturing sites, pipelines, and shipping facilities. Leakage from underground storage tanks, such as tanks at gasoline filing stations, can also add MTBE to groundwater. MTBE is not expected to concentrate in fish or plants found in lakes, ponds, and rivers (ATSDR 1996b). Exposure to MTBE can occur from auto exhaust when driving or from gasoline while fueling their cars. People can also be exposed to MTBE if they drink polluted groundwater. Low levels of MTBE can be present in both indoor and outdoor air, and are mostly linked with the use of MTBE as a gasoline additive.

MTBE, a chemical detected in the groundwater, was measured in the well sampling performed in 2006. Using the maximum concentration detected, doses were calculated to estimate the exposure that could have resulted from continuous intake of drinking water contaminated with this chemical. The dose estimates calculated are 2.49×10^{-4} mg/kg/day for adults and 5.44×10^{-4} mg/kg/day for

children. Comparing these estimates to ATSDR's MRL value of 0.3 mg/kg/day, it can be determined that MTBE is not found in significantly high enough concentrations to cause adverse health effects to residents ingesting the water. The concentrations of MTBE will continue to be monitored and, when available, new estimates will be made.

More is known about how MTBE affects the health of animals than the health of humans. There is evidence that MTBE can affect kidney function in male and female rats exposed at doses as low as 100 mg/kg/day (90 days, oral gavage). At higher doses and longer exposure duration (250 and 1000 mg/kg/day respectively, oral gavage for two years), there is evidence that MTBE caused lymphoma and leukemia in female rats and testicular Leydig cell tumors in male rats (Belpoggi et al. 1995 as described in ATSDR 1996b).

Cancer classification for MTBE is currently under review, therefore the cancer risk from exposure to MTBE is unknown (EPA 2006b). An investigation of cancer incidence in the Bountiful/Wood Cross area did not find any cancers that were statistically significantly increasing in the Bountiful/Wood Cross area as compared to the state of Utah from 1978–2001 (ATSDR 2004b).

The remaining contaminants of concern were not detected in the groundwater samples and therefore were not elevated above CV. In this instance, the contaminants were not further evaluated or discussed.

It is important to note that the characteristics of a groundwater PCE plume are not stable and constantly changing. Although the sampling conducted in 2006 accurately describes past exposures to these contaminants, it is not indicative of current plume conditions or concentrations. The plume will have migrated over time, with the degradation of PCE to other breakdown products likely. Current and continued sampling thereafter will aid in a better understanding of the plume characteristics, as well as the impact the plume may have on public health in the area.

Multiple Chemical Exposure Evaluation

The potential for the toxic effects from the chemical mixture interactions of the contaminants found in groundwater at the Bountiful/Woods Cross Plume were evaluated. The health impact of exposure to chemical mixtures and the potential for combined action of chemicals may be of concern at hazardous waste sites. These chemical concerns will be evaluated when sampling data becomes available using the Hazard Index (HI), which is a summation of the hazard quotients for all chemicals to which an individual has been exposed, divided by its MRL or comparable value. If the HI is less than 1.0, it is highly unlikely that significant additive or toxic interactions would occur. If the HI is greater than 1.0, further evaluation is necessary (ATSDR 2005).

If the HI for the chemical mixture at this site is greater than 1.0, the estimated doses for each individual chemical will then be compared to their NOAELs or comparable values. Doses of chemicals that are less than one-tenth of their respective NOAELs are unlikely to contribute to significant additive or interactive effects with other chemicals in the mixture.

Following the strategy recommended by ATSDR's Guidance Manual for the Assessment of Joint Toxic Action of Chemical Mixtures (ATSDR 2004c), one ATSDR Interaction Profile was

referenced for the health effects of mixtures containing 1,1,1-trichloroethane, 1,1-dichloroethane, trichloroethylene, and tetrachloroethylene (ATSDR 2004d). This Interaction Profile listed one possible effect concerning vinyl chloride and trichloroethylene. Physiologically based pharmacokinetic (PBPK) model simulations demonstrated a less-than-additive interaction of competitive metabolic interactions between vinyl chloride and trichloroethylene with respect to liver enzyme levels. However, these interactions only occurred at relatively high concentrations.

Cancer Incidence

The EEP conducted an investigation of cancer incidence in the Bountiful/Wood Cross area. This investigation evaluated cancer incidence in four census tracts; 1267.00, 1269.01, 1270.03, and 1270.04, respectively. These census tracts comprise the Bountiful/Woods Cross area. Although the Five Points PCE plume lies solely in the 1269.01 census tract, the surrounding areas were also analyzed due to the close proximity of the 5th South PCE plume in Bountiful.

A review of the cancer data for the Bountiful/Woods Cross area was performed to evaluate whether an environmental link exists between the contaminants of concern at the site and cancer incidents in the area. The cancer review data was also conducted in response to residents concerns about elevations in cancer incidence in their area. Although all cancers were evaluated in the study, results for cancers both specifically correlated with exposure to the contaminants of concern and statistically significant were further discussed.

Cancer Data

Cancer data for all primary cancers occurring in Utah residents from 1975 through 2004 are obtained from the Utah Cancer Registry (UCR). The UCR is partially funded by the National Cancer institute (NCI, Contract # N01-35141) with additional support from the Utah Department of Health and the University of Utah. In 1973 the UCR become one of the original members of the NCI Surveillance, Epidemiology and End Results (SEER) program. The UCR adheres to the SEER data standards (UCR 2006). Data obtained from the UCR were geo-coded and geo-referenced to the residential address at time of diagnosis by the Utah Environmental Public Health Tracking Network (UEPHTN). Geocoding was conducted using ArcGIS (version 9) geocoding functionality and the Dynamap/2000 (version 14.3) Street File Network for the State of Utah obtained from Geographic Data Technology, Inc (GDT 2004) for the address reference data. Data were projected to the North American Datum (NAD) 1983 Universal Transmercator (UTM) Zone 12N. Geographic boundary data in the same project for the US 2000 Census geographic units were obtained the Utah Automated Geographic Reference Center (AGRC 2005). This data was indexed by the Standard Federal Identifier (STFID) key. The STFID is comprised of the state and county Federal Information Processing Standards (FIPS) codes and the U.S. 2000 census tract and census block group enumeration codes (ITL 1990, USCB 2004). Currently, 89% of the data records are geocoded. The identity of U.S. 2000 census block group geographic area in which the geocoded address resides in is added to the geo-coded cancer record. Some non-geocodeable records can be assigned to the census tract geography based on available address information. Over 96% of the records are annotated with the census tract where the case resided at time of diagnosis. All records are annotated with a county of residence. Cancers are grouped by diagnostic codes into 42 major sites by the UCR. The UCR

also provides information about the sequence of primary cancers for a case.

There have been several contaminants of concern for the Bountiful/Woods Cross population affected by the Five Points PCE plume and these contaminants have been associated with various cancer types. All cancer types with one of more cases during the study period were analyzed; however, the process focused on cancers that may be linked to exposure to the contaminants of concern in the Five Points PCE plume area.

All cancers that were evaluated for rates during the study period are listed below. Cancer types with an asterisk (*) have been associated with the contaminants of concern at the Five Points PCE plume in Woods Cross.

Gastrointestinal Tract
- Oral cavity and Pharynx
- Stomach
- Colon
- Rectum and Rectosigmoid
- Small Intestines
- * Liver
- Gallbladder and Biliary Ducts
- Pancreas
- Other digestive system

Blood and Lymph
- * Hodgkin's Lymphoma
- * Non-Hodgkin's Lymphoma
- * Multiple Myeloma
- * Acute Lymphocytic Leukemia
- * Chronic Lymphocytic Leukemia
- * Other Leukemia

Urinary Tract
- Bladder
- * Kidney and Renal Pelvis
- Anus, Anal cavity, and anorectum
- Other Urinary (non-specific)

Head and Neck
- Eye and Orbit
- * Brain
- Thyroid
- Other Central Nervous System
- Other Endocrine

Skin, Bone, and Soft Tissue
- Bones and Joints
- Soft Tissue (including heart)
- Cutaneous Melanoma
- Other non-specific skin cancers

Female-Specific
- * Breast
- * Cervix
- * Uterus
- * Ovary
- Other female genital

Respiratory Tract
- Larynx
- Lung and Bronchus
- Other Respiratory Tract (non-specific)

Male-Specific
- * Prostate
- * Testis
- Other male genital

Census Data

Commercially available U.S. census population data for the U.S. 1970, 1980, 1990 and 2000 censuses were obtained from Geolytic, Inc. (Geolytic 2002 a-f). Geolytic tabulated and made available 1990 census data in the 2000 census geography. Census data were organized into 5-year (0-4, 5-9, 10-14, 15-19 … 70-74, 75-79, 80-84) age and sex groups through age 84 and additional groups for population 85 years and older for each sex. Population count data for each age and sex group were obtained for each of Utah's 1,481census block group geographic areas from 1990 and 2000 census data. Data for 1970 and 1980 were proportioned into the 2000 census block group geographic areas based on the ratio between the 1990 data at the census block group and the next smallest geographic area available in the 1970 and 1980 censuses. For urban counties, census tract was available with key for matching areas. For the rural counties, county is the smallest geographic tabulation area. Intercensal years and years projecting from 2000 to 2009 were computed by linear regression for each census block group. Population counts for Utah's 496 current census tract geographic areas and 29 counties were derived by aggregating the population for the appropriate census block groups. A comparison of the derived county population with those provided by Geolytic demonstrated minimal error for 1970 and 1980 and no error for 1990 and 2000.

Analytical Application

The Rapid Inquiry Facility (RIF) version 3.1.1 is a Visual Basic for Applications (VBA) macro extension to ESRI® ArcGIS software. The RIF provides linkage to user developed spatial, health outcome, population and covariate data, and a simple menu driven process to define a study query on those data and disease mapping and risk analysis statistical functionality that utilizes empirical Bayes smoothing techniques. The RIF was developed by the Small Area Health Statistics Unit (SAHSU) at the Department of Epidemiology and Public Health, Imperial College London (Aylin et. al. 1999, Jarup 2004).

Analysis

The RIF was programmed to evaluate the incidence and risk of cancers by cancer site for six 5-year analytical periods (1975-1979, 1980-1984, 1985-1989, 1990-1994, 1995-1999, 2000-2004) and the 30-year study period (1975-2004). All primary cancers were included. Analysis was conducted using the Utah 2000 census population as the standard population for age and sex adjustment. Cancers in Davis County census tracts 1267.00, 1269.01, 1270.03 and 1270.04 were compared with the rate of cancers of the same site for the State of Utah. The RIF computes a direct adjusted rate and indirect adjusted relative risk.

Standardized incidence ratios were calculated for each period and used to determine if a greater or lower risk of developing cancer exists as compared with the comparison population. Confidence intervals (95%) were applied to determine if a statistically significant difference had occurred in the number of observed cases versus the number of expected cases. Incidence rates were also age-adjusted to the 2000 U.S. Standard population (per 100,000 person years). Definitions of statistical analyses are included in Appendix C.

Results

The results of the cancer incidence investigation found that three cancer types were statistically

significantly increased at a greater frequency in the four census tracts as compared to the state of Utah in specific five-year analytical periods from 1975–2004. Those statistically significant included brain cancer (1995-1999), testicular cancer (1980-1984) and lung and bronchial cancer (1975-1979). When the data was separated into male and female classifications and reevaluated, several cancers that were not significantly increased demonstrated incidence rates consistently higher than the state of Utah in several cancers examined during at least one of the periods evaluated. These included the following male cancers: colon cancer (1975-1979), pancreatic cancer (1995-1999) and other leukemia (1985-1989). The female cancer results significant included: Hodgkin's lymphoma (1985-1989) and (1975-2004), brain cancer (1995-1999) and (1975-2004), and bladder cancer (2000-2004). The results of the cancer incidence for the cancers of most concern to this study are given in Appendix D.

The most common cancers resulting from chronic exposure to PCE include esophagus, bladder, blood and liver. Although brain, testicular and lung/bronchial cancers were significantly elevated in the cancer incidence study conducted in Woods Cross, these are not the primary cancers attributed to exposure to PCE and its derivatives. Many researchers believe that a causal link between brain cancer and PCE exposure may exist; however, further research is needed to validate this link. Currently, the elevations in specific cancers observed in the city of Woods Cross are considered indeterminate as to whether they were directly caused by the environmental contaminants detected at the site.

CHILD'S HEALTH CONSIDERATIONS

ATSDR recognizes that the unique vulnerabilities of infants and children demand special emphasis in communities faced with contamination of their water, soil, air, or food. Children are at a greater risk than are adults from certain kinds of exposures to hazardous substances emitted from waste sites and emergency events. Children are more likely to be exposed because they play outdoors and because they often bring food into contaminated areas. They are more likely to come into contact with dust, soil, and heavy vapors close to the ground. Also, they receive higher doses of chemical exposures because of lower body weights. The developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages.

The cancer incidence investigation conducted by the EEP evaluated cancer incidence rates in four census tracts (1269.01, 1270.00, 1270.03, and 1270.04) also examined the incidence of pediatric cancers in the Bountiful/Wood Cross area and found no excess of cancer among the age group of 0 to 18 years of age.

COMMUNITY HEALTH CONCERNS

In addition to the community needs assessment for the Five Points PCE Plume which will be completed through the UDOH, the UDOH will also work with the UDEQ to conduct an analysis of community health concerns using a needs assessment tool with the residents living within the affected site area. The responses from this tool will help to determine the environmental concerns from the viewpoint of the community and will allow health education programs to be developed to address these concerns. A public meeting forum will also be scheduled and conducted to hear the concerns of the residents and the information gathered at this meeting will be used to determine the educational and health activities undertaken in the community.

Following the completion of these activities, the results will be compiled and presented in the subsequent PHA for the Five Points PCE plume site. The community will have another opportunity to express concerns during any educational activities held in the community (i.e., public forums and meetings) as well as during the public release of the document, which requires a public comment period.

CONCLUSIONS

PCE contamination of municipal wells has occurred in the past; these wells have since been shut down and are not currently being used as a municipal water source to residents and businesses in the affected area. However, new sampling needs to be conducted to quantify the extent of contamination and to determine if other environmental media (i.e., air, groundwater, and soil) have been impacted. In addition, the degradation products of PCE also need to be monitored to determine if concentrations present could affect human health.

Although PCE is used in dry cleaning processes and numerous dry cleaners once operated or are currently operating in the area, the contamination has not been attributed to any specific facility. Both EPA and UDEQ are working with local dry cleaning facilities in the area to remove underground storage tanks which may contain PCE and its degradation products.

There is currently no health hazard to the community from exposure of PCE in groundwater and drinking water; concentrations of PCE are not above MRL levels. This could change, however, and the concentrations of these contaminants will need to be monitored closely. The public health hazard for air, soil and sediment are currently not well understood. Additional sampling needs to occur in these media in order to adequately assess exposures to soil, air, and surface water. At present, the shallow groundwater is not a source of municipal drinking water. However, if the contaminants are not removed or contained, migration of contaminants to the deeper aquifers could occur, and the drinking water supply for over 77,000 area residents could be jeopardized.

EPA and UDEQ continue to study the site to determine both the vertical and horizontal delineations of the plume, as well as the concentrations of contaminants of concern. Once the extent of contamination is fully determined, then remediation activities will be discussed and implemented.

Significant concern over health and environmental issues exist in the area. Community members have expressed a desire for information regarding health and environmental concerns and will continue to obtain such details from newspapers, newsletters, and word-of-mouth.

There were three cancers that occurred at a statistically greater frequency in the Bountiful/Woods Cross area as compared to the state of Utah from 1975–2004. These included brain cancer (1995-1999), testicular cancer (1980-1984), and lung and bronchial cancer (1975-1979).

RECOMMENDATIONS

- UDEQ & EPA should continue to sample drinking water supplies, including both municipal and residential wells, to determine the presence, concentration and distribution of contaminants. It is recommended that this sampling continue until remediation is complete and contaminants are shown not to be entering drinking water aquifers.

- EPA and UDEQ should continue to study the site to determine both the vertical and horizontal delineations of the plume, as well as the concentrations of contaminants of concern. Once the extent of contamination is fully determined, then remediation activities will be discussed and implemented.

- Significant concern over health and environmental issues exist in the area. Community members have expressed a desire for information regarding health and environmental concerns and will continue to obtain such details from newspapers, newsletters, and word-of-mouth. EEP should provide the communities living near the Five Points PCE Plume site with available health information about the contaminants of concern.

- UDEQ should continue to sample all pertinent exposure pathways for contaminants of concern, including PCE and its derivatives.

- EEP and the Davis County Local Health Department will monitor development of commercial and residential property near the site and activities on the site that could further facilitate migration of contaminants.

- Reevaluate all exposure pathways and doses once required sampling has been conducted and update this document into a public health assessment upon the examination of new data.

PUBLIC HEALTH ACTION PLAN

A public health action plan will be implemented by the UDOH EEP in conjunction with other government agencies at and near the vicinity of the Five Points PCE Plume. The purpose of a public health action plan is to ensure that this health consultation provides a plan of action designed to mitigate and prevent adverse human health effects resulting from exposure to hazardous substances in the environment from the Five Points PCE Plume. The public health action plan will include all of the following elements.

1. The EEP community health educator will conduct an environmental health needs assessment of the community and this will be used as a guide to address any future community concerns. The health educator will also provide the community with all available information regarding the site, contaminants of concern, and any remediation efforts. A pamphlet discussing the results of the final public health assessment will be created and delivered to area residents.

2. EEP will collaborate with EPA, UDEQ and local water suppliers to monitor the area drinking water supplies until remediation is complete and contaminants are shown not to be entering the drinking water supply.

3. UDEQ and the EPA will continue to research the site, including plume delineation and remediation alternatives.

4. EEP will monitor sampling of the residential wells conducted by EPA and UDEQ that are reported to be drinking water sources. EEP will provide residential well owners information on the contaminants identified in the groundwater and potential health effects.

5. EEP will continue to monitor additional sampling of air, soil, and surface water conducted by EPA and UDEQ.

6. EEP will encourage annual sampling of the two groundwater wells that occasionally serve employees at the Woods Cross Refinery, until the source of contamination has been identified and/or until contaminants are shown not to be migrating into the deeper aquifers.

7. EEP, in coordination with the Davis County Health Department, will monitor the development of commercial property near the site and activities on the site that could further facilitate migration of contaminants off-site.

8. The EEP will provide the communities living near the Five Points PCE Plume with cancer and site remediation information.

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CERTIFICATION

This Health Consultation, **Five Points PCE Plume, Woods Cross, Davis County, Utah**, was prepared by the Utah Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the public health assessment was begun. Editorial review was completed by the Cooperative Agreement partner.

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

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APPENDICES

APPENDIX A- MAPS OF STUDY AREA AND DATA

Figure 1. Aerial map depicting the Five Points PCE plume in Woods Cross, Davis County, Utah. The blue shape defines a five acre area surrounding the plume that may be affected or impacted. The location of the sampling wells are shown. The top of the map is north.

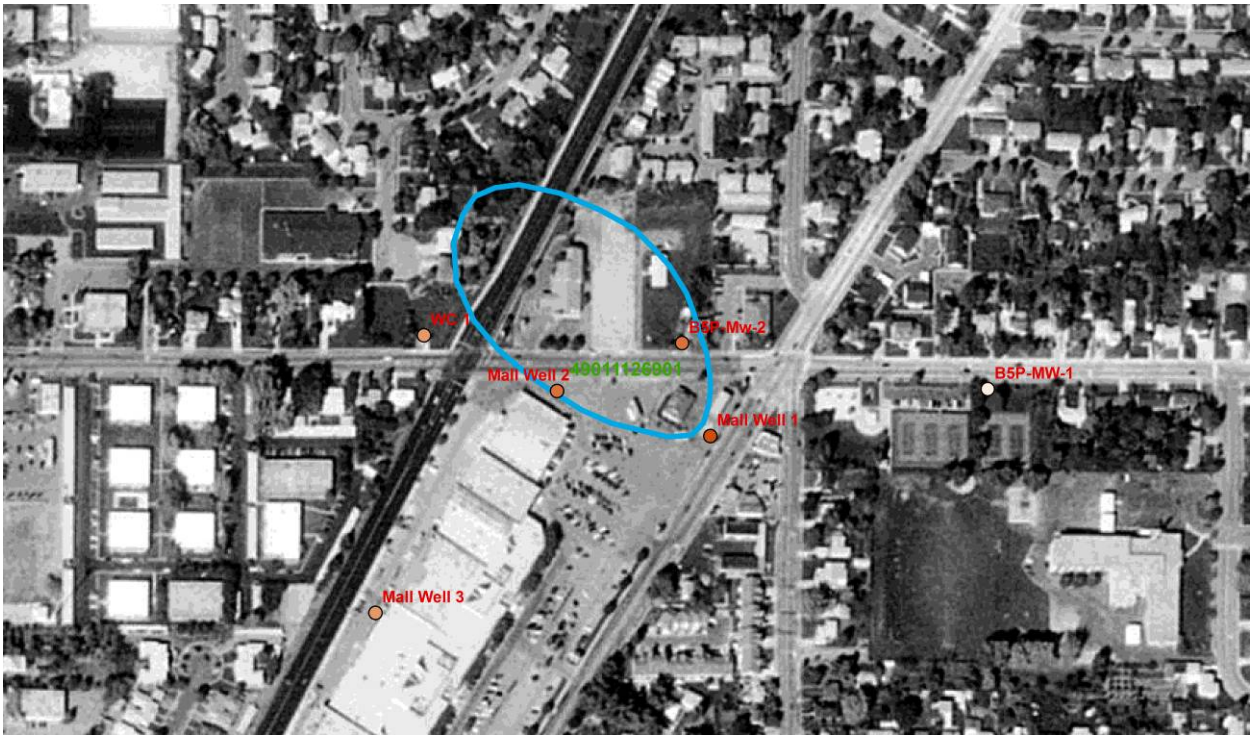

Figure 2. Larger map depicting the Five Points PCE plume (small red dot and accompanying blue circle) in Woods Cross in relation to the larger 5th South PCE plume (large blue square) in Bountiful. The location of the sampling wells are also shown. Due to the fact that the Five Points plume contamination has yet to be fully delineated and the close proximity between the two sites, it is plausible that these two plumes may join. The top of the map is north.

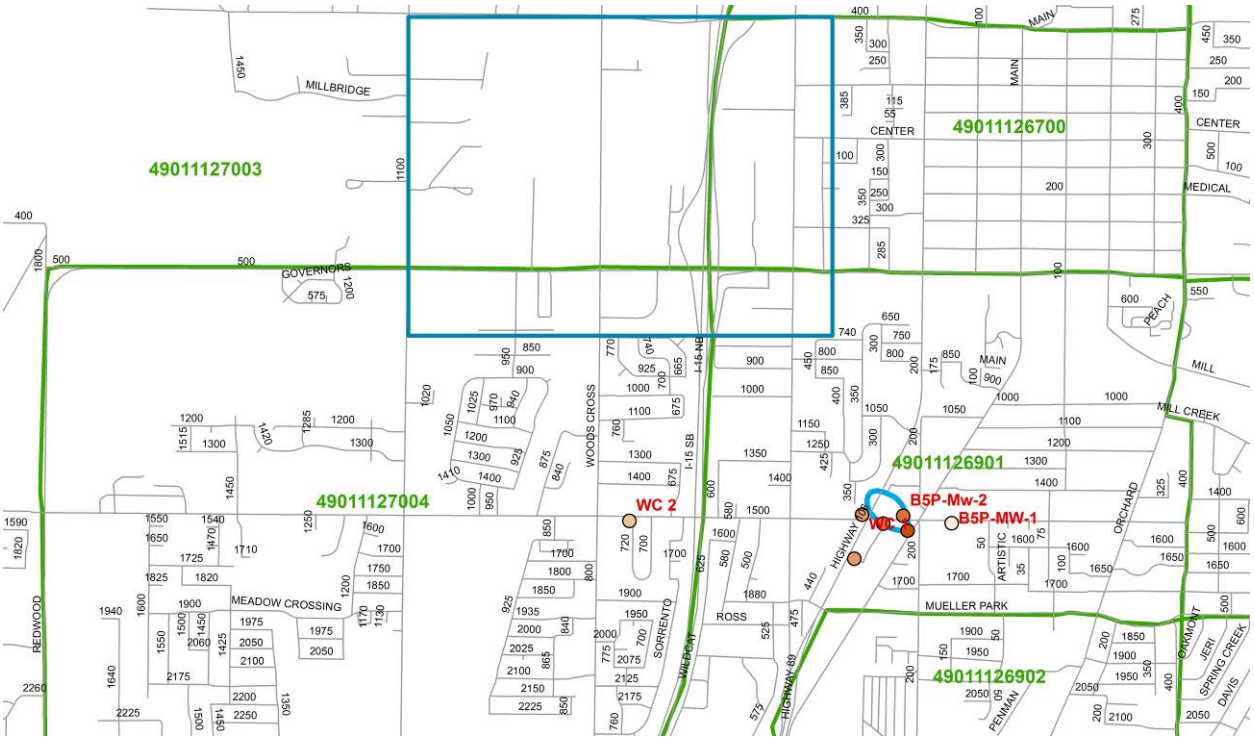
49011127003
49011126700
49011126901
49011127004
49011126902
WC 2
B5P-Mw-2
B5P-MW-1
MILLBRIDGE
GOVERNORS
CENTER
MAIN
MEDICAL
PEACH
MILL
MILL CREEK
WOODS CROSS
I-15 SB
I-15 NB
HIGHWAY
ORCHARD
ARTISTIC
MUELLER PARK
ROSS
SORRENTO
WILDCAT
HIGHWAY 89
REDWOOD
MEADOW CROSSING
PENMAN
DAVIS
SPRING CREEK
JERI
CARMONT

Table 1. Volatile Organic Contaminant Results for Ground Water Collected from Municipal and Monitoring Wells at the Five Points PCE Plume Site on September 11, 2006.

Sample #	**B5P-MW-1**	**B5P-MW-2**	**B5P-MW-3**	**B5P-MW-4**	**B5P-MW-5**		
Sample Location	**Collected from Municipal Well WC #1**	**Collected from Municipal Well WC # 2**	**Collected from Monitoring Well MW-1 (1581 South 550 West)**	**Collected from Monitoring Well MW-2 (Westwood Circle)**	**Field Duplicate from Monitoring Well MW-2**	**CV* (µg/L)**	**Type of CV****
Sample Time	9:30	9:17	17:26	16:30	9:22		
Depth to Groundwater	160 ft.	76 ft.	99.7 ft.	103.2 ft.	76 ft.		
Analyte (µg/L)							
Vinyl Chloride	ND	ND	ND	ND	ND	2	MCL
Methylene Chloride	ND	ND	ND	ND	ND	5	MCL
trans-1,2-Dichloroethene	ND	ND	ND	ND	ND	100	MCL
Methyl-Tert-Butyl-Ether (MTBE)	ND	ND	**8.7**	ND	ND	3,000	MCL
1,1-Dichloroethane	ND	ND	ND	ND	ND	N/A	N/A
cis-1,2-Dichloroethene	ND	ND	ND	ND	ND	70	MCL
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	200	MCL
Benzene	ND	ND	ND	ND	ND	5	MCL
Trichloroethene (TCE)	ND	ND	**0.44**	ND	ND	5	MCL
Tetrachloroethene (PCE)	**6.3**	1.8	**24**	1.8	1.8	5	MCL
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	0.2	CREG

* CV = Comparison Values

** MCL = Maximum Contaminant Level and CREG = Cancer Risk Evaluation Guide

APPENDIX B- STATISTICAL CALCULATIONS

Comparison Values
Comparison values (CVs) are used in public health assessments and serve as a screening tool to identify contaminants that will require further evaluation.

Comparison Value Calculations
Each year, ATSDR updates their list of Comparison Values for selected compounds in soil, air, and water. EMEGs, RMEGs, and CREGs are all examples of comparison values. When the compound of interest is not listed, comparison values can be calculated as follows:

for non-carcinogenic health effects:
EMEG = MRL x BW / IR

RMEG = R_fD x BW / IR

for carcinogenic health effects:
CREG = $10E^{-6}$ x BW / IR x OSF

Where:	EMEG	=	Environmental Media Evaluation Guide (ppm)
	MRL	=	Minimal Risk Level (mg/kg/day)
	RMEG	=	Reference Dose Media Evaluation Guide
	R_fD	=	Reference Dose
	CREG	=	Cancer Risk Evaluation Guide for $1x10^{-6}$ excess cancer risk
	OSF	=	Oral Slope Factor
	BW	=	Body Weight (kg)
		=	70 kg for an adult
		=	16 kg for a child
	IR	=	Water Ingestion rate (liter/day)
		=	2 L/day for an adult
		=	1 L/day for a child

Exposure Dose
The comparison value calculations described above are derived using standardized exposure assumptions. At some sites, the existing conditions may result in exposures that differ from those used to derive Comparison Values such as the EMEG. In these situations, the health assessor can calculate site-specific exposures more accurately using an exposure dose. The exposure dose can then be compared to the appropriate toxicity values (MRL, RfC, RfD).

Calculating Exposure Dose (ED) for drinking water [ATSDR 2005]:

ED = {(C x IR x EF) / BW}

Where: C = Contaminant level (mg/liter)

IR = Water Ingestion rate (liter/day)
= 2 liters/day for an adult
= 1 liter/day for a child

EF = Exposure Factor; an exposure factor of "1" was used for this health assessment (1 represents daily exposure to the contaminant rather than intermittent exposure. This assumes that the person is using home water as the primary drinking source).

BW = Body Weight (kg)
= 70 kg for an adult
= 16 kg for a child

APPENDIX C- STATISTICAL DEFINITIONS

DEFINITIONS

Age-Adjustment

Different populations have different numbers of people who are different ages. Cancer rates increase as people get older; therefore, it is not ideal to compare two populations with a different number of older persons. Although the cancer rates in two populations may look different at first due to the age structure of the populations not being identical, upon further examination there may not be a real difference when the same specific age groups are examined (i.e., all persons under 18 years of age or over 65 years of age). Age adjustment helps to control for this discrepancy by comparing the cancer rates between specific age groups rather than between whole populations.

Confidence Interval

A confidence interval is used to help determine significance. When a statistical test is performed, the result is only an estimate of the true result. A confidence interval gives a range of values for the results; for example, a 95% Confidence Interval would signify that there is a 95% chance that the true value of the results exists somewhere in the range given. If the confidence interval of an SIR (defined below) includes 1.0, then the result is not statistically significant, because there is a greater than five percent chance that the difference found is due to chance alone. If a confidence interval does not include 1.0, then the result is statistically significant; however, this only shows significance and therefore does not prove that the cancer rates are elevated.

Significance

A result is described as statistically significant when it can be shown that the probability of obtaining such a result by chance alone is relatively low (generally less than five percent). Therefore, if a finding is significant, 95% of the time that result will represent a true difference.

Standard Incidence Ratio (SIR)

An SIR is an estimate of the occurrence of cancer in a population relative to what might be expected if the population had the same cancer experience as some larger comparison population designated as “normal” or average. Usually, the population of the entire state is used as the comparison population. An SIR is calculated by dividing the number of observed cancer cases by the expected number of cancer cases.

An SIR of 1.0 indicated that rates observed in the population evaluated equals the number of cancer cases expected in the comparison population. An SIR of greater than 1.0 indicates that more cancer cases occurred in the observed population than the comparison population and an SIR less than 1.0 indicates that fewer cancer cases occurred than expected (Massachusetts Department of Public Health 1998).

APPENDIX D- CANCER INCIDENCE RESULTS

LIVER CANCER

Table 1. Annual age-adjusted liver and interhepatic bile duct cancer incidence rates in five-year time periods from 1975-2004 and cumulative from 1975-2004 for the affected population of Bountiful/Woods Cross, Utah.

Time Period	Bountiful/Woods Cross Rate per 100,000	Bountiful/Woods Cross Observed Cases	SIR[1]	95% CI[2]
1975-1979	2.78	2	2.83	0.34, 10.23
1980-1984	1.67	1	0.97	0.00, 5.43
1985-1989	1.06	1	0.74	0.02, 4.11
1990-1994	1.00	1	0.61	0.02, 3.37
1995-1999	4.30	4	1.83	0.50, 4.69
2000-2004	2.02	2	0.99	0.99, 3.58
1975-2004	2.07	11	0.60	0.60, 2.15

[1] Standard Incidence Ratio
[2] 95% Confidence Interval
(Utah Cancer Registry, 1975-2004)

KIDNEY CANCER

Table 2. Annual age-adjusted kidney and renal pelvic cancer incidence rates in five-year time periods from 1975-2004 and cumulative from 1975-2004 for the affected population of Bountiful/Woods Cross, Utah.

Time Period	Bountiful/Woods Cross Rate per 100,000	Bountiful/Woods Cross Observed Cases	SIR[1]	95% CI[2]
1975-1979	4.12	3	0.97	0.20, 2.84
1980-1984	3.85	3	0.83	0.17, 2.42
1985-1989	3.25	3	0.71	0.15, 2.09
1990-1994	2.08	2	0.41	0.05, 1.48
1995-1999	8.16	7	1.29	0.52, 2.66
2000-2004	3.20	3	0.42	0.09, 1.22
1975-2004	4.29	21	0.73	0.45, 1.12

[1] Standard Incidence Ratio
[2] 95% Confidence Interval
(Utah Cancer Registry, 1975-2004)

BRAIN CANCER

Table 3. Annual age-adjusted brain cancer incidence rates in five-year time periods from 1975-2004 and cumulative from 1975-2004 for the affected population of Bountiful/Woods Cross,

Utah.

Time Period	Bountiful/Woods Cross Rate per 100,000	Bountiful/Woods Cross Observed Cases	SIR[1]	95% CI[2]
1975-1979	3.46	2	0.63	0.08, 2.27
1980-1984	8.30	6	1.63	0.60, 3.54
1985-1989	5.02	4	0.88	0.24, 2.26
1990-1994	3.43	≤3	0.63	0.13, 1.84
1995-1999	13.67*	13*	2.53*	1.35, 4.33*
2000-2004	9.78	9	1.74	0.80, 3.31
1975-2004	7.45	37	1.39	0.98, 1.92

[1] Standard Incidence Ratio
[2] 95% Confidence Interval
(Utah Cancer Registry, 1975-2004)
* Statistically significant increase (p = 0.05) from the expected number of cases

BLOOD CANCER
LYMPHOCYTIC LEUKEMIA

Table 4. Annual age-adjusted lymphocytic leukemia incidence in five-year time periods from 1975-2004 and cumulative from 1975-2004 for the affected population of Bountiful/Woods Cross, Utah.

Time Period	Bountiful/Woods Cross Rate per 100,000	Bountiful/Woods Cross Observed Cases	SIR[1]	95% CI[2]
1975-1979	2.60	2	0.65	0.08, 2.33
1980-1984	6.49	5	1.14	0.46, 3.29
1985-1989	2.41	2	0.50	0.06, 1.79
1990-1994	2.95	3	0.77	0.16, 2.25
1995-1999	4.72	4	1.03	0.28, 2.65
2000-2004	3.49	3	0.62	0.13, 1.80
1975-2004	3.70	19	0.82	0.49, 1.27

[1] Standard Incidence Ratio
[2] 95% Confidence Interval
(Utah Cancer Registry, 1975-2004)

MYELOID LEUKEMIA

Table 5. Annual age-adjusted myeloid leukemia incidence rates in five-year time periods from 1975-2004 and cumulative from 1975-2004 for the affected population of Bountiful/Woods Cross, Utah.

Time Period	Bountiful/Woods Cross Rate per 100,000	Bountiful/Woods Cross Observed Cases	SIR[1]	95% CI[2]
1975-1979	6.69	5	2.05	0.67, 4.80
1980-1984	3.48	3	1.10	0.23, 3.21
1985-1989	2.25	2	0.70	0.08, 2.51
1990-1994	3.08	3	0.94	0.19, 2.76
1995-1999	3.08	3	0.82	0.17, 2.40
2000-2004	2.18	2	0.49	0.06, 1.78
1975-2004	3.43	18	0.95	0.56, 1.51

[1] Standard Incidence Ratio
[2] 95% Confidence Interval
(Utah Cancer Registry, 1975-2004)

OTHER LEUKEMIA

Table 6. Annual age-adjusted leukemia types other than lymphocytic and myeloid leukemia incidence rates in five-year time periods from 1975-2004 and cumulative from 1975-2004 for the affected population of Bountiful/Woods Cross, Utah.

Time Period	Bountiful/Woods Cross Rate per 100,000	Bountiful/Woods Cross Observed Cases	SIR[1]	95% CI[2]
1975-1979	0	0	-	-
1980-1984	0	0	-	-
1985-1989	2.88	2	4.11	0.50, 14.84
1990-1994	2.21	2	2.45	0.30, 8.85
1995-1999	0.68	1	1.38	0.03, 7.71
2000-2004	0.91	1	2.48	0.06, 13.79
1975-2004	1.12	6	1.64	0.60, 3.57

[1] Standard Incidence Ratio
[2] 95% Confidence Interval
(Utah Cancer Registry, 1975-2004)

HODGKIN'S LYMPHOMA

Table 7. Annual age-adjusted Hodgkin's lymphoma incidence in five-year time periods from 1975-2004 and cumulative from 1975-2004 for the affected population of Bountiful/Woods Cross, Utah.

Time Period	Bountiful/Woods Cross Rate per 100,000	Bountiful/Woods Cross Observed Cases	SIR[1]	95% CI[2]
1975-1979	4.89	3	1.68	0.35, 4.90
1980-1984	1.50	1	0.48	0.01, 2.70
1985-1989	6.63	5	2.52	0.82, 5.87
1990-1994	2.73	2	1.08	0.13, 3.92
1995-1999	1.16	1	0.47	0.01, 2.64
2000-2004	3.18	3	1.52	0.31, 4.45
1975-2004	3.24	15	1.29	0.72, 2.13

[1] Standard Incidence Ratio
[2] 95% Confidence Interval
(Utah Cancer Registry, 1975-2004)

NON-HODGKIN'S LYMPHOMA

Table 8. Annual age-adjusted non-Hodgkin's lymphoma incidence in five-year time periods from 1975-2004 and cumulative from 1975-2004 for the affected population of Bountiful/Woods Cross, Utah.

Time Period	Bountiful/Woods Cross Rate per 100,000	Bountiful/Woods Cross Observed Cases	SIR[1]	95% CI[2]
1975-1979	13.73	10	1.95	0.94, 3.59
1980-1984	6.60	5	0.77	0.25, 1.80
1985-1989	9.82	8	0.92	0.40, 1.82
1990-1994	13.63	12	1.09	0.56, 1.91
1995-1999	13.62	13	1.07	0.57, 1.83
2000-2004	11.46	12	0.86	0.44, 1.49
1975-2004	11.94	60	1.03	0.79, 1.33

[1] Standard Incidence Ratio
[2] 95% Confidence Interval
(Utah Cancer Registry, 1975-2004)

REPRODUCTIVE CANCER- MALE TESTICULAR CANCER

Table 9. Annual age-adjusted testicular cancer incidence in five-year time periods from 1975-2004 and cumulative from 1975-2004 for the affected population of Bountiful/Woods Cross,

Utah.

Time Period	Bountiful/Woods Cross Rate per 100,000	Bountiful/Woods Cross Observed Cases	SIR[1]	95% CI[2]
1975-1979	5.80	2	1.35	0.16, 4.88
1980-1984	16.99*	6*	3.77*	1.38, 8.21*
1985-1989	3.26	1	0.46	0.01, 2.56
1990-1994	4.74	2	0.79	0.10, 2.84
1995-1999	8.83	4	1.68	0.46, 4.29
2000-2004	6.48	≤3	0.94	0.19, 2.75
1975-2004	7.57	18	1.33	0.79, 2.10

[1] Standard Incidence Ratio
[2] 95% Confidence Interval
(Utah Cancer Registry, 1975-2004)
* Statistically significant increase (p = 0.05) from the expected number of cases

PROSTATE CANCER

Table 10. Annual age-adjusted prostate cancer incidence in five-year time periods from 1975-2004 and cumulative from 1975-2004 for the affected population of Bountiful/Woods Cross, Utah.

Time Period	Bountiful/Woods Cross Rate per 100,000	Bountiful/Woods Cross Observed Cases	SIR[1]	95% CI[2]
1975-1979	71.02	24	1.26	0.80, 1.87
1980-1984	54.63	18	0.70	0.42, 1.11
1985-1989	89.67	31	0.94	0.64, 1.34
1990-1994	159.62	65	1.16	0.90, 1.48
1995-1999	135.98	59	1.22	0.93, 1.58
2000-2004	109.87	51	0.92	0.69, 1.21
1975-2004	103.36	248	1.03	0.91, 1.16

[1] Standard Incidence Ratio
[2] 95% Confidence Interval
(Utah Cancer Registry, 1975-2004)

REPRODUCTIVE CANCER- FEMALE
BREAST CANCER

Table 11. Annual age-adjusted breast cancer incidence in five-year time periods from 1975-2004 and cumulative from 1975-2004 for the affected population of Bountiful/Woods Cross,

Utah.

Time Period	Bountiful/Woods Cross Rate per 100,000	Bountiful/Woods Cross Observed Cases	SIR[1]	95% CI[2]
1975-1979	70.41	24	1.09	0.70, 1.62
1980-1984	75.23	31	1.14	0.77, 1.61
1985-1989	69.37	29	0.82	0.55, 1.18
1990-1994	82.00	36	0.92	0.64, 1.27
1995-1999	80.06	38	0.87	0.61, 1.19
2000-2004	114.70	57	1.23	0.93, 1.59
1975-2004	82.40	215	0.99	0.87, 1.13

[1] Standard Incidence Ratio
[2] 95% Confidence Interval
(Utah Cancer Registry, 1975-2004)

CERVICAL CANCER

Table 12. Annual age-adjusted cervical cancer incidence in five-year time periods from 1975-2004 and cumulative from 1975-2004 for the affected population of Bountiful/Woods Cross, Utah.

Time Period	Bountiful/Woods Cross Rate per 100,000	Bountiful/Woods Cross Observed Cases	SIR[1]	95% CI[2]
1975-1979	2.58	1	0.42	0.01, 2.35
1980-1984	2.69	1	0.40	0.01, 2.25
1985-1989	9.77	4	1.39	0.38, 3.57
1990-1994	8.36	4	1.19	0.33, 3.06
1995-1999	2.31	1	0.36	0.01, 2.03
2000-2004	-	0	-	-
1975-2004	4.29	11	0.68	0.34, 1.21

[1] Standard Incidence Ratio
[2] 95% Confidence Interval
(Utah Cancer Registry, 1975-2004)

UTERINE CANCER

Table 13. Annual age-adjusted uterine cancer incidence in five-year time periods from 1975-2004 and cumulative from 1975-2004 for the affected population of Bountiful/Woods Cross, Utah.

Time Period	Bountiful/Woods Cross Rate per 100,000	Bountiful/Woods Cross Observed Cases	SIR[1]	95% CI[2]
1975-1979	19.65	6	0.76	0.28, 1.65
1980-1984	23.73	9	1.12	0.51, 2.13
1985-1989	22.91	10	1.26	0.60, 2.32
1990-1994	25.17	11	1.21	0.60, 2.17
1995-1999	22.96	11	1.22	0.61, 2.18
2000-2004	17.85	9	0.99	0.45, 1.88
1975-2004	21.48	56	1.10	0.83, 1.43

[1] Standard Incidence Ratio
[2] 95% Confidence Interval
(Utah Cancer Registry, 1975-2004)

OVARIAN CANCEER

Table 14. Annual age-adjusted ovarian cancer incidence in five-year time periods from 1975-2004 and cumulative from 1975-2004 for the affected population of Bountiful/Woods Cross, Utah.

Time Period	Bountiful/Woods Cross Rate per 100,000	Bountiful/Woods Cross Observed Cases	SIR[1]	95% CI[2]
1975-1979	24.89	8	2.00	0.86, 3.94
1980-1984	10.57	4	0.87	0.24, 2.22
1985-1989	11.12	4	0.83	0.23, 2.13
1990-1994	13.89	6	1.12	0.41, 2.44
1995-1999	16.79	8	1.53	0.66, 3.01
2000-2004	3.85	2	0.37	0.00, 1.34
1975-2004	12.96	32	1.10	0.75, 1.55

[1] Standard Incidence Ratio
[2] 95% Confidence Interval
(Utah Cancer Registry, 1975-2004)

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Agency for Toxic Substances and Disease Registry
Mailstop E-60
1600 Clifton Road, NE
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Date December 18, 2008

From Division of Health Assessment and Consultation, ATSDR

Subject Health Consultation
Five Points PCE Plume

To Glenn Tucker
Senior Regional Representative, ATSDR, Region VIII

Enclosed please find 2 hard copies and 3 CDs of the December 18, 2008 Health Consultation on the following site prepared by the Utah Department of Health and Environment under cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR).

FIVE POINTS PCE PLUME
WOODS CROSS, DAVIS COUNTY, UTAH

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Please address correspondence to the Agency for Toxic Substances and Disease Registry (ATSDR) Records Center, 1600 Clifton Road, NE (F09), Atlanta, Georgia 30333.

Freda Dumas
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Enclosures
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