Public Health Assessment

Community Concerns Evaluation,
Cheshire, Connecticut

Cheshire, New Haven County, Connecticut

Prepared by:

Connecticut Department of Public Health
Under a Cooperative Agreement with the
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

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A. Summary

This public health assessment (PHA) evaluates the validity of environmental health concerns of the community in Cheshire, Connecticut. Many of the community concerns focus on cancer and possible links with environmental contamination. The past contamination of volatile organic compounds (VOCs) in the town's drinking water supply is well known within the community and is the primary focus of this PHA.

Environmental assessments in Cheshire have focused on the past contamination of the public water supply. The town's public water supply was contaminated with VOCs from the late 1970s through the late 1980s. Aeration towers were installed, which reduced the VOC levels in the drinking water to below the drinking water standards. The VOCs found in the public water supply that exceeded drinking water standards were trichloroethylene (TCE) and 1,2-dichloropropane (DCP).

The possible ways people could have been exposed to contaminants in the public water supply in the past are through direct contact with the contaminated water (ingestion, skin contact, inhaling contaminated indoor air). Because the level of VOC contamination after 1988 was below drinking water standards, Cheshire residents who drank the water after this date were not exposed to contaminant levels of concern through this pathway.

In addition to the drinking water data, we evaluated environmental data from 17 sites of concern in the Cheshire community for their overall effect on Cheshire residents. Environmental data show that onsite soil and groundwater is/was contaminated at many of the 17 sites. In addition, contamination from at least one or two sites affected three private wells. In general, soil contamination at the 17 sites is not significant or widespread and access is limited at most sites. Thus, the Connecticut Department of Publich Health (CT DPH) has concluded that significant exposure to soil contamination is unlikely.

To evaluate public health implications from contaminants in the public and private water supply or from any of the sites of concern in Cheshire in the past or present, CT DPH first considered the available data and how people might become exposed to contaminants. If there is no exposure, then there is no threat to public health. In cases where exposure is possible, CT DPH compared maximum concentrations of contaminants with health-protective comparison values. This screening step rules out exposures that are likely to result in adverse health impacts. When contaminant concentrations exceeded comparison values, CT DPH further evaluated the exposures to determine the likelihood that such exposures would result in adverse health effects.

In the public water supply and in three private wells, TCE and DCP were evaluated further because they were present at levels above comparison values (only TCE was found to be above comparison values in the private wells). CT DPH estimated a likely exposure period for TCE and DCP and made conservative estimates of TCE and DCP levels in the Cheshire public water supply and three private wells. CT DPH then estimated noncancer and cancer risk from TCE and DCP exposure in the public water supply and three private wells. Cancer and noncancer risks from TCE and DCP exposure in the public water supply were found to

be minimal. CT DPH has concluded that past exposures to TCE and DCP in the public water supply present No Apparent Public Health Hazard. As for past exposures to TCE in private wells, exposures and risks may have been very high and could have presented a public health hazard. However, dose and risk estimates for exposures to private well water are highly uncertain because of a lack of data. For this reason, conclusions about public health hazards from past exposure to TCE in private well water are also highly uncertain.

CT DPH evaluated health outcome data in Cheshire for the years 1975–2000. Overall, there does not appear to be significant elevations of cancer incidence in Cheshire. Non-Hodgkin's lymphoma and leukemia have been associated with TCE (the primary contaminant previously found in Cheshire's public water supply) exposure in human studies and are therefore biologically plausible outcomes in Cheshire. However, the cancer risks calculated for these two tumor types are not consistently, nor strongly elevated during the periods that were analyzed. Breast cancer was found to be elevated during the most recent time period evaluated. However, breast cancer has not been associated with TCE exposure, so the elevation in this cancer during the most recent period is not likely a result of environmental exposure.

ATSDR has a categorization scheme whereby the level of public health hazard at a site is assigned to one of five conclusion categories. Based on a review of the available environmental data, cancer and noncancer risks, and health outcome data, CT DPH has determined that past exposure to TCE and DCP in the public water supply in Cheshire presented No Apparent Public Health Hazard in the past. Although past exposures to contaminants did occur, the exposures were below levels seen to have caused health effects in toxicology and epidemiology literature.

CT DPH received community health concerns during meetings and public advisory sessions with the Cheshire Community Advisory Panel (CAP), government officials, as well as residents. Their concerns have been identified and addressed in this public health assessment document.

From its evaluation of the environmental data, CT DPH recommends the following actions:

- CT DPH and the Chesprocott Health Department should continue to work with the community leaders to educate them about specific environmental issues in the town of Cheshire;
- CT DPH and the South Central Connecticut Regional Water Authority (RWA) should continue to work together to ensure that the public water supply is safe;
- CT DEP, RWA, and CT DPH, and the EPA should continue to monitor the remaining 12 sites on the Comprehensive Environmental Response, Compensation, and Liability Information System List [1] (CERCLIS) to ensure that any groundwater contamination immediately beneath the site is not leaching into the public water supply or any nearby private wells and if there are any sites with contaminated soil

[1] CERCLIS was established by the United States Environmental Protection Agency (EPA) and contains information on hazardous waste sites, potential hazardous waste sites, and remedial activities across the nation, including sites that are on the National Priorities List (NPL) or being considered for the NPL or Superfund list. The NPL is a national listing of the sites EPA deems significant of needing cleanup

that are accessible to the public, access to the areas should be restricted; CT DEP needs to continue to monitor the odors from Dalton Enterprises to ensure that they do not violate any regulations;

- because of safety issues in Alling Lander, CT DPH recommends that the site be fenced to prevent trespassers from entering the site; and
- CT DPH recommends that further evaluation of the sites Alling Lander, County Wide Construction, and Cheshire Municipal Landfill be undertaken to help determine if remediation is necessary.

A draft version of this Public Health Assessment was made available for public comment from April 13, 2004 through June 8, 2004. CT DPH held a public availability session to answer questions and take comments on May 13, 2004. CT DPH also prepared a fact sheet summarizing this Public Health Assessment. The fact sheet was made available at the public availability session. CT DPH received comments from several parties. The comments and responses are listed in Appendix K. The fact sheet is provided in Appendix L.

B. Purpose

In August 2002, the Agency for Toxic Substances and Disease Registry (ATSDR) was petitioned by a resident of Cheshire, Connecticut to evaluate the environmental community concerns of the town, many of which stem from a history of health concerns, specifically cancer, and possible links with environmental contamination. The past contamination of volatile organic compounds (VOCs) in the town's drinking water supply is well known within the community.

This Public Health Assessment (PHA) responds to the petition by evaluating environmental data, with a focus on the public water supply, and by addressing community concerns, with a focus on cancer and 17 sites of concern. The PHA also responds to specific citizen's concerns and presents conclusions regarding whether people have or could have been exposed to environmental contamination. It assesses whether the exposure could affect public health and identifies any further studies or actions that are needed. The PHA does not provide answers to causes of specific illnesses in individuals. It also does not identify a specific source of the contamination of the public water supply, which is unknown.

The Connecticut Department of Public Health (CT DPH), Division of Environmental Epidemiology and Occupational Health, prepared this PHA under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR), U.S. Department of Health and Human Services. This document examines available environmental data on contaminants in the public water supply and other media in Cheshire, Connecticut. It evaluates whether exposure to these contaminants could occur and considers possible health effects. Community health concerns related to environmental contamination in Cheshire are also identified and addressed.

C. Background

1. Cheshire History

Cheshire, Connecticut, a residential community in New Haven County, has a population of 26,190. Originally a part of the Town of Wallingford, Cheshire was settled in 1694 and incorporated as a town in May of 1780. Located in the south central section of the state, Cheshire is approximately 14 miles north of New Haven and 25 miles southwest of Hartford, easily accessible from Interstates 84, 91, and 691 and State Routes 70, 68, and 10. The town has a land area of 33 square miles and is bounded on the north by Southington and Wolcott, on the east by Meriden and Wallingford, on the south by Hamden, and on the west by Prospect and Waterbury.

For its first 170 years, Cheshire was predominantly a rural farming community. During the past 50 years, the town has become a residential suburban community. Despite significant industrial and commercial growth, Cheshire retains its rural characteristics with thousands of acres of open space and an active agricultural industry. Cheshire has been designated the "Bedding Plant Capital of Connecticut" by the Connecticut General Assembly because of its bedding plant growers.

2. Description of Cheshire Public Water Supply Systems

a. Site Description—Public Water System

Cheshire's public water system is supplied by two well fields: the north Cheshire well field and south Cheshire well field. Two treatment facilities in town, one for each of the well fields, remove VOC contamination from the water.

North Cheshire Well Field

The North Cheshire Well field consists of six wells, four of which are currently active. The well field, located off State Route 10 in north Cheshire, is in the Quinnipiac River drainage basin. All of the wells draw from stratified drift aquifers. Table 1 below provides details about the wells and Appendix A provides a map of the well field in Cheshire. CT DPH also obtained pumping rates, depths, and diameters for all of the wells.

Table 1. North Cheshire Well field Details

Well #	Service Start Date	Comments
1	1959	——
2	1971	*Inactive*
3	1976	*Removed from service, placed in emergency status* in 1994*
4	1974	——
5	1989	——
6	1993	——

* Refers to a source of supply identified by the water company within its water supply emergency contingency plan for possible use at various stages of an emergency. An emergency source is not an active source and is not considered part of available water.

The RWA owns approximately 115 acres of land surrounding the North Cheshire wellfield. Most of the recharge area (land area where water infiltrates the soil to replenish the aquifer) is undeveloped. Extensive tracts of land in northern Cheshire are used for agriculture (in the form of crops and greenhouse growers) and the mining of sand and gravel. Some strawberry farming also took place south of the well field. Forests and open meadowlands bordering the Quinnipiac River and Honeypot Brook are used for passive recreation. Much of the land that is currently undeveloped, including nearly the entire zone of contribution of these wells, is zoned for industrial use. The remainder is designated for ½-acre or 1-acre residential zoning and interchange zone, a district that permits a mixture of office and commercial uses.

The RWA maintains a network of five monitoring wells used to check the water quality of the groundwater throughout the north Cheshire wellfield. Water level measurements are taken quarterly from each of these wells. Water from these wells is sampled for VOCs on a quarterly basis. There are also 24 monitoring wells strategically placed throughout the north Cheshire aquifer, which are monitored, periodically for groundwater level.

The RWA conducts an aggressive source protection program in its recharge area. Current source protection activities include inspections, reviews of proposed development plans, efforts to achieve better regulatory protection, public education, and emergency spill response.

South Cheshire Well Field

The south Cheshire wellfield is part of the Mill River Drainage Basin. The map in Appendix A shows the location of the south Cheshire wellfield, which is in Cheshire, east of South Main Street (State Highway Route 10). The well field has two gravel-packed wells. Table 2 provides details about the wells. CT DPH was also provided with the depth, diameter, and pumping rates of the wells in the south Cheshire well field.

Table 2. South Cheshire Well Field Details

Well #	Start Service Date
1	1977
2	1979

Much of the recharge area for the south Cheshire well field is zoned for residential use, with lots from ½ to 2 acres. The recharge area does include a commercial zone along South Main Street. A commercial strip includes a plant nursery, small businesses that routinely use solvents and other organic chemicals, and several gas stations and vehicle repair facilities. Municipal sanitary sewers and public water are available throughout most of the south Cheshire wellfield recharge area. The RWA south Cheshire property is 14.8 acres, but they do not own any additional land overlying the aquifer. The RWA draws data from the 13 monitoring wells on the south Cheshire wellfield aquifer. Of these, four are located on the well field property arranged in a north, south, east, and west pattern, centering on the production wells.

b. History of the Public Water Distribution System

From 1908 though 1958, the RWA built and installed a network of water mains that distributed water to customers from a reservoir on the Prospect/Cheshire line (Prospect Reservoir). During this time, all of the water came from the reservoir. In 1959, the first community well was added to the distribution system. This well, north well # 1, was joined by others as the north Cheshire well field was developed. The last well (north well # 6) was added to this well field in 1993. A second well field (south Cheshire well field) was developed in the southern part of town and two wells went into service in this well field in 1977 and 1979.

In 1958, the RWA served an estimated population of 9,200 persons through 2,351 service connections. The RWA defines “service connections” as the actual hard-piped connections to buildings. All of the water at this time (yearly total of 180.0 million gallons) came from the Prospect Reservoir. In 1959, north well # 1 was the first addition to the distribution system. During this year, an unknown amount of blended water from this well and 187.2 million gallons from the reservoir reached an estimated 9,600 consumers through 2,410 service connections. (The total yearly draft for the well #1 was not available until 1960.) Table 3 shows how many days out of the year each of the Cheshire Distribution System's three community water sources contributed to the overall community water supply. It shows that the Prospect Reservoir was taken off-line in 1978, the same year that the south well field was brought on-line. It also shows that the south well field was on-line for very few days in 1982, 1983, and 1984. These were the years of concern regarding contamination. The south Cheshire aeration treatment facility was completed in 1985. Subsequent contamination levels were well below advisory levels. Data from Table 3 provide an overall picture of the way the water was blended from the three water sources.

From 1959 through 1977, water supplied by the RWA consisted of a mixture of surface water from the reservoir plus water from the two well fields, as they came on line. In 1978, the reservoir was taken off line for reasons related to capitol costs to comply with the SDWA requirements. At this point, the two well fields became the sole sources of water distributed to Cheshire customers of the RWA. A detailed chronological history of events pertaining to the water distribution system in Cheshire may be found in Appendix B of this report.

Currently, approximately 20,463 of Cheshire's 26,190 residents are served by a public water supply system operated by the South Central Connecticut Regional Water Authority (RWA). The remainder of the residents use private wells to satisfy their water demand.

c. Environmental Contamination History

North Cheshire Well Field

In 1979, the RWA began sampling the water in the north and south Cheshire well fields for VOCs. Testing prior to this date was not required nor feasible with laboratory techniques at that time. *There is no way of knowing whether any contamination existed before 1979*. A contaminant called trichloroethylene (TCE) was discovered by the RWA in north wellfield wells #1 and #4 in June of 1979. The origin of TCE, a common industrial solvent, was from an unidentified source to the north of this well. Despite intensive investigation by the Connecticut Department of Environmental Protection (CT DEP), the source of the TCE was never discovered. Note that from 1977 through July of 1979, well #'s 1 and 4 were the only production wells operating in the north well field. In August 1979, high levels of TCE were found in two samples taken from well # 4 and lower levels were found at the same time in well #1. As a result of these findings, well # 4 was taken off of the supply line, remaining off-line from September through part of October 1979. During the latter part of October 1979 through the end of June 1980, well # 4 was used as a barrier well to intercept the contaminated groundwater and prevent it from reaching production well # 1. Well #4 went back online as a production well in June 1980. At this time, well #5 (originally drilled in 1979) was used as a barrier well. Well #5 continued to function as a barrier well until 1989, when it was put online as a production well.

Table 3. Cheshire Distribution System – Comparison Over Time

Year	Estimated Population Served	No. Service Connections	Prospect Reservoir Total Draft* (MG)†	North Cheshire Wells Total Draft (MG)	South Cheshire Wells Total Draft (MG)	No. Days in Service (Prospect Reservoir/North Cheshire/ South Cheshire)	Comments
1959	9,600	2,410	187.2	No Info	—	365/0/0	North Cheshire well #1 online—December
1960	13,383	2,461	158.7	94.8	—	366/366/0	
1961	14,092	2,555	203.9	15.9	—	365/365/0	
1962	13,700	2,646	217.0	107.7	—	365/152/0	
1963	13,700	2,796	196.5	189.5	—	365/196/0	
1964	14,200	2,899	184.5	226.7	—	366/190/0	
1965	14,600	3,040	228.4	170.1	—	365/219/0	
1966	14,900	3,137	192.9	173.7	—	365/212/0	
1967	15,400	3,295	281.8	54.2	—	365/151/0	
1968	16,000	3,441	309.0	170.8	—	366/312/0	
1969	17,400	3,603	181.7	258.0	—	209/265/0	
1970	18,100	3,668	373.4	178.9	—	365/238/0	
1971	19,300	3,751	260.3	262.5	—	365/345/0	
1972	13,854	3,877	363.4	196.4	—	325/255/0	
1973	14,076	4,045	397.7	254.2	—	365/311/0	
1974	14,722	4,090	409.5	217.9	—	365/235/0	North Cheshire well #4 added
1975	14,949	4,172	427.5	179.9	—	365/255/0	
1976	15,178	4,246	186.0	402.6	—	157/346/0	North Cheshire well #3 added
1977	15,758	4,389	83.8	542.2	—	77/342/0	
1978	17,459	4,516	Off-line	478.6	182.2	0/364/173	Prospect Reservoir off-line; south Cheshire well #1 online
1979	17,729	4,674	—	522.4	205.7	0/365/292	North Cheshire well #4 off-line
1980	17,278	4,727	—	377.1	253.9	0/366/366	South Cheshire well #2 added
1981	17,578	4,775	—	355.5	278.1	0/365/363	
1982	17,799	4,799	—	494.7	9.6	0/365/20	South Cheshire well field taken off-line

*Total draft refers to the total amount of water per year used for the public water supply from a source.

†Million gallons.

Please note: The time duration for the table only extends from 1959–1982 because data from this time period were used to estimate TCE concentrations since finished water data was not available for the time period.

Wells #3, #4, and #5 were used at some point as barrier wells as well as one additional well, “Observation Well #13,” through the 1980s to protect the production wells until a treatment facility consisting of packed column aeration towers was completed in 1987 to remove TCE and any other VOCs from water in the north Well field. These columns have been effective in removing 95%–99% of the contaminants to levels below the maximum contaminant level (MCL) for TCE of 5 parts per billion (ppb) or micrograms per liter (µg/L) that was established in 1994. MCLs are national drinking water standards set by the U.S. Environmental Protection Agency (EPA) that are enforceable and are protective of public health to the “extent feasible” (ATSDR, 1992)

Routine monitoring by the RWA detected a second chemical, 1,2-dichloropropane (DCP), in the north well field in November 1983. This contaminant is present in Vorlex, a soil fumigant used in agricultural activities occurring south of the well field. It is also removed by aeration, as is TCE.

South Cheshire Well Field

TCE was also discovered in both of the wells in the south Cheshire well field in November of 1981. The well field was taken off-line in January of 1982, then put back on-line for drinking water use in June of 1983. Even though the well field was contaminated from June 1983–December 1985 (TCE levels exceeded current MCLs until the end of 1984), the RWA continued to use it on a conditional basis, as approved by CT DPH (Drinking Water Division), mostly in the summer months. An aeration tower water treatment facility was completed in June of 1985.

In August of 1984, DCP appeared in one sample of finished water (water that has been blended and/or treated for potable use) from the south well field for the first time. The south well field was used to supply drinking water only when necessary to meet demand, or if the north well field was out of service. The south well field was taken off-line from November 1984 through May 1985. The aeration tower treatment facility was completed in July 1985. Samples of finished water for DCP and TCE since the installation of the towers have been usually near or below the limit of detection and always below MCLs.

Low levels of other VOCs (1,1,1-trichloroethane, and tetrachloroethylene) have been detected in the north and south well fields over the years. However, the amounts were below current drinking water standards, and therefore, not considered for further evaluation.

d. Site Visit/Well Fields

On June 18, 2003, CT DPH staff visited the north and south Cheshire well field, which provide most of the water to the public supply system in Cheshire. Both well fields are completely enclosed by fences, which prevented CT DPH staff from accessing the sites on this date.

3. Other Sites of Concern

“Cancer in Cheshire,” a community website (http://www.cancerincheshire.com/), listed 16 sites of concern to residents in August 2002. These 16 sites were at some point (or still are) on the EPA Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) list. Currently, 12 of these sites listed on the website are on the EPA CERCLIS list.

CERCLIS was established by EPA and contains information on hazardous waste sites, potential hazardous waste sites, and remedial activities across the nation, including sites that are on the National Priorities List (NPL) or being considered for the NPL or Superfund list. The NPL is a national listing of the sites EPA deems significant of needing cleanup. Of these 12 current CERCLIS sites, only one was ever listed as a Superfund site (Cheshire Associates, NPL site until 1997) and the other 11 do not have NPL (Superfund) status. Sites on the current CERCLIS list include Airpax Corporation, Alling Lander Company, Carbide Mold, Cheshire Associates, Cheshire Municipal Landfill, County Wide Construction, Oslo Control, Peerless Screw, Suburban Excavators, Superior Steel Products, TRW-DOT Fastener Division, and U.S. Chemical Corporation. Sites that have been removed from the CERCLIS list include Ball and Socket Lagoon, Bovano's, Holgrath Corporation, and Olin Corporation.

Because of the community concern over these 16 sites and concerns about them being a source of contamination to the public drinking water supply, they are evaluated in this PHA. These CERCLIS sites, however are not a major focus of the PHA, because contamination from the CERCLIS sites has not had a major exposure effect on the overall Cheshire community. One additional site—Dalton Enterprises/Ball and Socket Manufacturing Company—is included because of the significant level of community concern over this site, although it has never been on the CERCLIS list. In total, 17 sites of concern (Dalton Enterprises and the 16 sites that are or were CERCLIS sites) are evaluated. Contamination of the private and public water supply, potentially affected by several of these sites, is discussed in detail. Appendix C provides a brief description of the sites, their sampling history, and their effect on the Cheshire community. Data from these sites are summarized and interpreted in Section 4, Environmental Contamination.

a. Site Visits/Waste Sites

On June 18, 2003, CT DPH and Chesprocott Health Department staff briefly visited the 17 Cheshire sites and the north and south Cheshire well field. The visits were not detailed inspections. They were conducted to obtain a general impression of the location and status of each site.

Three of the sites visited—Cheshire Municipal Landfill, Alling Lander, and County Wide Construction—were of particular concern because they may still need remediation or capping. In addition, safety at Alling Lander is a concern. CT DPH staff observed that the building on the property was vandalized and unsafe.

4. Demographics

The population of Cheshire has grown significantly over the years. The 1950 U.S. Census recorded a population of 6,295 for the town. In 1960, the population had more than doubled. By 2000, the population was reported to be 28,543. The racial breakdown for Cheshire, as determined by Census 2000, was 89% Caucasian, 5% African-American, 4% Hispanic, and 2% other.

5. Environmental Contamination

a. Cheshire Public Water Supply

Water samples for VOCs were collected monthly from the Cheshire public water supply after 1986. On or before 1986, samples were collected from the public water supply with varying frequency, depending on the operational status of the well field. At times, the data were not available, because no established governmental guideline for sampling frequency existed at the time. The number of samples obtained monthly during each collection varied for the same reasons. When the RWA refers to “raw water,” this is untreated water sampled directly from the wellhead. “Finished water” refers to water that has been treated according to the drinking water standards specified in the CT Public Health Code, section 19-13-B102. This process involves adding a disinfectant (chlorine) when needed for control of coliform bacteria, and the addition of fluoride. It may also involve blending waters from different sources and/or aeration treatment.

Note that all laboratory results discussed in this section are compared with current standards, established in 1994. *These current standards (MCLs) were not in existence when the samples were originally collected.* A table of historical MCLs and other guidance available at the time, such as s*uggested no adverse response levels* (SNARLS) of TCE and DCP, can be found in Appendix D. The RWA operated the well fields consistent with the SNARLS, advisories, and MCLs, as these standards became available, and in consultation with the CT DPH (Drinking Water Division).

North Cheshire Well Field

The current federal drinking water standard (MCL) for TCE is 5 parts per billion (ppb; 5 µg/L). In June and August 1979, high levels of TCE were found in the three (3/3) water samples taken from well #4 at levels of 42 ppb, 54 ppb, and 110 ppb. Well #4 was subsequently shut down and used as a barrier well until June 1980. From June–December 1979, 14/17 of the samples from well #1 were found to have TCE levels above the current MCL of 5 ppb.

Table 4 shows the 1978–2002 ranges of TCE concentration in raw and finished water from the north Cheshire well field. The table also shows the number of samples exceeding the current MCL versus the number of samples collected. The TCE levels peaked in 1979 and 1980. In 1985 and 1986, even though the levels were much lower than those of the early 1980s, TCE concentrations in most of the finished water samples exceeded the current MCLs. TCE levels significantly decreased over time to below the current MCL in early 1989. That decrease probably resulted from the use of the aeration treatment towers, beginning in 1987, and CT DEP’s intervention in several businesses in the area that may have been contaminating the public water supply.

TCE levels for one sample, taken from this well in November 1979, were highly elevated (200 ppb). This was, however, the only sample result that exceeded 50 ppb that year. The highest result, 200 ppb, may be viewed suspiciously when taken in context with the other data. It could have resulted from a laboratory or sampling error. The most conservative approach would be to assume that the highest value of 200 ppb of TCE is accurate, especially because results for a raw water sample taken in 1980 reached TCE levels of 249 ppb. CT DPH chose the more conservative approach and used the sampling result of 200 ppb in calculating the average TCE concentration for 1979. Appendices E-G provide estimated average TCE concentrations and doses for the pubic water supply in Cheshire.

Table 4. North Cheshire Well Field TCE Values in ppb

Note: The current maximum contaminant level (MCL) is 5 ppb

Year	Range in Raw Water (ppb)	Range in Finished Water (ppb)	Number of Raw Water Samples Exceeding Current MCL/Number of Samples Collected	Number of Finished Water Samples Exceeding Current MCL/Number of Samples Collected
1979	1.2–200	4.1–48	17/20	3/4
1980	<1–249	NA	24/82	NA
1981	ND–13.1	NA	2/45	NA
1982	ND–3.4	ND–10.2	0/5	NA*
1983	<1–7.2	<1–10.7	1/11	NA*
1984	<1–32	ND-97	NA*	2/101
1985	0.7–23.5	3.1–12.4	NA*	116/126
1986	NA	2–27	NA	131/151
1987	NA	<1–3.0	NA	0/177
1988	NA	<1–6.0	NA	1/307
1989	NA	<1–3.0	NA	0/116
1990	NA	<1	NA	0/47
1991	NA	<0.5	NA	0/48
1992	NA	<0.5	NA	0/24
1993	NA	<0.5	NA	0/14
1994	NA	<0.5	NA	0/11
1995	NA	<0.5	NA	0/14
1996	NA	<0.5	NA	0/13
1997	NA	<0.5	NA	0/17
1998	NA	<0.5	NA	0/14
1999	NA	<0.5	NA	0/15
2000	NA	<0.5	NA	0/15
2001	NA	<0.5	NA	0/16
2002	NA	<0.5	NA	0/15

NA—Not available
NA*—Individual sample data not available
ND—Not detectable
Bold indicates year at which the aeration towers were built.

Routine monitoring by the RWA detected a second chemical (1,2-dichloropropane [DCP]) in the north well field in November 1983. The RWA began sampling for DCP in 1979, but the first clear detection of DCP occurred in 1983. Therefore, CT DPH has assumed that finished water in the north Cheshire well field was not contaminated with DCP before 1983. Details about DCP contamination levels in the north well field may be found in Table 5. In 1983, there were no guidelines or standards for DCP in drinking water, although in 1984, CT DPH issued a health advisory level of 10 ppb for DCP. The current MCL for DCP is 5 ppb. The DCP concentration detected in 1983 in raw water was much lower than the levels of TCE observed (maximum concentration was 12.4 ppb in finished water). The DCP contamination peaked in 1984 and 1985, when most samples taken exceeded the current MCL. DCP levels declined to below the MCL and eventually to below detection limits after 1987, when the aeration towers were built.

Table 5. North Cheshire Well Field DCP Values in ppb

Note: the current MCL for DCP is 5 ppb.

Year	Range In Raw Water (ppb)	Range In Finished Water (ppb)	Number of Raw Water Samples Exceeding Current MCL/Number of Samples Collected	Number of Finished Water Samples Exceeding Current MCL/Number of Samples Collected
June 1979	ND	ND	NA*	NA*
1980	ND	NA	NA	NA
1981	<10	<10	NA	NA
1982	NA	NA	NA	NA
1983	5.9**	NA	1/1	NA
1984	NA	ND–9.0	NA	92/99
1985	NA	2.8–12.4	NA	86/126
1986	NA	6	NA	1/150
1987	NA	<1–3.0	NA	0/166
1988	NA	<1–1.0	NA	0/327
1989	NA	<1	NA	0/108
1990	NA	<1	NA	0/47
1991	NA	<0.5	NA	0/48
1992	NA	<0.5	NA	0/24
1993	NA	<0.5	NA	0/14
1994	NA	<0.5	NA	0/11
1995	NA	<0.5	NA	0/14
1996	NA	<0.5	NA	0/13
1997	NA	<0.5	NA	0/17
1998	NA	<0.5	NA	0/14
1999	NA	<0.5	NA	0/15
2000	NA	<0.5	NA	0/15
2001	NA	<0.5	NA	0/16
2002	NA	<0.5	NA	0/15

NA—Not Available
NA*—Individual sample data not available
ND—Not Detectable
**Only one concentration was available from well #1 taken in November 1
Bold indicates year at which the aeration towers were built.

South Cheshire Well Field

TCE was also discovered in the south Cheshire well field in November of 1981. Water from the south Cheshire well field was sampled in 1979–1980 and TCE was not present during that time. The highest amounts found in November 1981 were 46 ppb in raw water and 32 ppb in finished water. Levels continued to rise, reaching a high in January 1982 of 174 ppb in raw water. The aeration tower was completed in 1985. From 1985 through 2001, maximum finished water levels were below the MCL and below 2 ppb after 1988. Table 6 lists TCE contamination levels for the south well field.

In August of 1984, DCP appeared in finished water from the south well field for the first time. DCP was first sampled for in the south Cheshire well field in 1979 and was not found. The DCP concentrations in August 1984 were still quite low, ranging from a nondetectable level to 6.2 ppb. DCP in samples of finished water, since a year after the installation of the aeration towers in 1985, has been below the current MCL of 5 ppb. After 1986, DCP has been below detectable limits (see Table 7).

Low levels of two other VOCs (tetrachloroethylene and 1,1,1-trichloroethane) were detected in the north and south well fields over the years. Those were generally below current drinking water standards, and therefore, not considered for further evaluation.

Table 6. South Cheshire Well Field TCE Values in ppb

Note: The current MCL for TCE is 5 ppb.

Year	Range In Raw Water (ppb)	Range In Finished Water (ppb)	Number of Raw Water Samples Exceeding Current MCL/Number of Samples Collected	Number of Finished Water Samples Exceeding Current MCL/Number of Samples Collected
1979	<1	<1	NA*	NA*
1980	<1	ND	NA*	NA*
1981	46	32	NA*	NA*
January 1982	20–174	NA	19/19	NA
1983	NA	<1–22.5	NA	48/72
1984	NA	<1–7.6	NA	9/81
1985	NA	0.5–4.4	NA	0/96
1986	NA	ND-11	NA	1/230
1987	NA	<1–4.0	NA	0/312
1988	NA	<1–2.0	NA	0/166
1989	NA	<1	NA	0/33
1990	NA	<1	NA	0/32
1991	NA	<1	NA	0/42
1992	NA	<0.5	NA	0/20
1993	NA	<0.5	NA	0/13
1994	NA	<0.5	NA	0/11
1995	NA	<0.5	NA	0/15
1996	NA	<0.5–1.9	NA	0/48
1997	NA	<0.5–1.4	NA	0/66
1998	NA	<0.5–1.3	NA	0/51
1999	NA	<0.5–1.3	NA	0/52
2000	NA	<0.5–0.8	NA	0/52
2001	NA	<0.5–0.8	NA	0/50
2002	NA	<0.5–0.8	NA	0/61

NA—Not available
NA*—Individual samples results not available
ND—Not detectable levels
Bold indicates year at which the aeration towers were built.

Table 7. South Cheshire Well Field DCP Values in ppb

Note: The current MCL for DCP is 5 ppb.

Year	Range In Raw Water	Range In Finished Water	Number of Raw Water Samples Exceeding Current MCL/Number of Samples Collected	Number of Finished Water Samples Exceeding Current MCL/Number of Samples Collected
1979	ND	ND	NA*	NA*
1980	ND	ND	NA*	NA*
1981	<10	<10	NA*	NA*
1982	NA	NA	NA	NA
1983	NA	NA	NA	NA
1984	NA	ND–6.2	NA	3/54
1985*	NA	ND–3.9	NA	0/96
1986	NA	ND–4	NA	0/228
1987	NA	<1	NA	0/312
1988	NA	<1	NA	0/166
1989	NA	<1	NA	0/33
1990	NA	<1	NA	0/32
1991	NA	<1	NA	0/42
1992	NA	<0.5	NA	0/20
1993	NA	<0.5	NA	0/13
1994	NA	<0.5	NA	0/11
1995	NA	<0.5	NA	0/15
1996	NA	<0.5	NA	0/48
1997	NA	<0.5	NA	0/66
1998	NA	<0.5	NA	0/51
1999	NA	<0.5	NA	0/52
2000	NA	<0.5	NA	0/52
2001	NA	<0.5	NA	0/50
2002	NA	<0.5	NA	0/61

NA—Not Available
NA*—Individual samples results not available
ND—Not Detectable Levels
Bold indicates year at which the aeration towers were built.

b. Other Sites of Concern

Of the 17 sites in Cheshire evaluated for this current assessment, 16 were at some point on the CERCLIS list. Dalton Enterprises/Ball and Socket Manufacturing was added to the PHA site list because of public concern over the site. (See Appendix C for detailed descriptions of the sites.) After the discovery of VOCs in the Cheshire public water supply, about half of these sites were sampled in the early to mid-1980s for onsite groundwater VOC contamination. Shallow groundwater was discovered to be contaminated above current drinking water standards at several of the sites. The highest concentration of TCE in groundwater was 1,500 ppb of TCE, which was found at County Wide Construction. Groundwater sampling data is unavailable for U.S. Chemical Company, although the site was thought to have affected nearby groundwater wells, such as those serving Peerless Screw and Oslo Controls. Monitoring wells related to about four other sites were first sampled in the early to mid-1990s for VOC contamination. Three quarters of those sites were found to have VOC concentrations above current drinking water standards. These results, and those from the 1980s (Alling Lander, Ball and Socket Lagoon, Bovano's, Carbide Mold, County Wide Construction, Oslo Controls, Peerless Screw, Suburban Excavators, U.S. Chemical Corporation, and 604 West Johnson Street) also prompted action by CT DEP to require site cleanups.

Some sites have a history of onsite soil contamination. About five sites were sampled in the early to mid-1980s and two in the early 1990s for soil contamination. A few of these sites (Bovano's, Cheshire Landfill, and Ball and Socket Lagoon) had soil contamination, but sampling results are not available. Two of the sites sampled (Superior Steel and Cheshire Municipal Landfill) were found to have soil total petroleum hydrocarbon (TPH) levels above Connecticut's Remediation Standard Regulations Industrial Direct Exposure Criteria for Soils (CT RSRs). The industrial soil RSRs are clean-up standards developed to be protective of workers who receive frequent, intense contact with soil over the long term.

In some areas near the sites, private well water samples were taken. Only one area (about four homes) had VOC levels above current drinking water standards. This area was near Alling Lander and County Wide Construction. CT DEP named Alling Lander at least partially responsible for the contamination of the private wells and required the company to provide potable water to the homes until they were connected to the public water supply in 1990. Four of the private residential wells tested in the area had TCE levels above current drinking water standards. The maximum concentration of TCE in these wells was 141 ppb. Three or four private residences were hooked up to public water.

In summary, most of the 17 sites had some soil and groundwater contamination onsite in the past, but most of the sites have been cleaned up and are no longer contaminated. Some sites, such as Alling Lander, County Wide, and the Cheshire landfill, may still be contaminated and need to be remediated or capped. In addition, even though there is onsite soil contamination, there is no evidence that it has affected soil on nearby residential properties. With regard to groundwater, contamination from these sites has affected private wells and may have affected the public water supply. A site visit by DPH staff noted several safety issues at the Alling Lander site. Access to this site is currently not restricted.

6. Exposure Pathway Analysis

To decide whether Cheshire residents were, are, or could be exposed to environmental contamination, CT DPH evaluated all available data and how people might come into contact with contaminants. For exposure to occur, a completed exposure pathway is necessary. A completed pathway exists if five elements are present:

1) a source of contamination
2) transport through an environmental medium
3) a point of exposure
4) a route of human exposure; and
5) an exposed population.

A potential pathway exists if one of the five elements is missing, but could exist. An exposure pathway can be eliminated from further evaluation if at least one of the elements is missing and will never be present. If there is no completed pathway, then it can be concluded that there is no health risk. However, if there is a completed or potential pathway, environmental data is compared with screening levels (comparison values). Comparison values are levels below which there is little likelihood of harmful health effects. TCE and DCP have been found in Cheshire's public drinking water and private water at levels above current drinking water standards. In this PHA, we used MCLs as comparison values (screening levels).

a. Completed Exposure Pathways

In Cheshire, the only completed exposure pathway is through contaminated drinking water. Residents could have been exposed to TCE or DCP in water by drinking, skin contact, or by inhalation during activities such as bathing or showering. This pathway is evaluated in the Public Health Implications section.

b. Potential Exposure Pathways

The exceedances of RSRs in soil at the sites of concern discussed in Appendix C are relatively small (at most, approximately 5 times above CT RSRs). In addition, soil levels exceed RSRs in only a few small areas of two sites (Superior Steel and Cheshire Municipal Landfill). Furthermore, the types of activities that might have occurred in these areas by workers or trespassers (for example, walking, mowing grass, etc.) are not likely to result in frequent or intense contact with soil over long periods. In addition, we do not expect small children to have played on these sites. Given these considerations, CT DPH believes that it is very unlikely that trespassers or workers received significant exposure to contaminants in the soil. It is also unlikely that significant exposures would occur in the future.

It is possible that some exposure could have occurred in the past or could occur in the future. However, the potential exposures would involve small numbers of people and certainly would not be likely to affect the overall health status of the Cheshire community.

For all of these reasons, CT DPH has eliminated the potential exposure pathway of soil contamination from further evaluation in this Public Health Assessment.

D. Discussion

1. Chemical Specific Information

This section provides general toxicology information for the contaminants found in Cheshire drinking water and is not intended to imply that these effects are likely in Cheshire. Section D2, Public Health Implications to Children and Adults, discusses possible health effects to Cheshire residents.

a. Trichloroethylene (TCE)

Trichloroethylene (TCE) is also known by various trade names, including Trilene and Vitran. It is a nonflammable, colorless liquid at room temperature with a somewhat sweet odor and a sweet, burning taste. TCE is mainly used as a solvent to remove grease from metal parts. It is also used as a solvent in other processes and is used to make other chemicals. TCE can be found in some household products, including typewriter correction fluid, paint removers, adhesives, and spot removers. It was also used as an anesthetic for surgery (ATSDR 1997).

ATSDR's extensive toxicology database shows that TCE exposure is associated with a wide variety of adverse health effects. TCE has the potential to induce neurotoxicity, immunotoxicity, developmental toxicity, liver toxicity, kidney toxicity, and endocrine effects. People who are exposed to large amounts of TCE can become dizzy or sleepy and may become unconscious at very high levels. Death may occur from inhalation of large amounts of TCE. Skin contact may produce rashes. Inhalation of moderate levels of this solvent may cause headaches and dizziness. At high levels, exposure to TCE may cause facial nerve, kidney and liver damage, and heartbeat changes. Some animal and human studies have suggested that birth defects may be a result of exposure to TCE (ATSDR 1997).

Epidemiological studies have linked TCE exposure to excess risk of kidney, liver, lympo-hematopoietic, cervical, and prostate cancer. In animals, TCE exposure has resulted in liver tumors, lung tumors, and lymphomas in mice. Rats have developed kidney and testicular tumors after exposure to TCE (ATSDR 2001). One study suggests that children who drank high levels of TCE in drinking water may have had a higher incidence of childhood leukemia than other people, but the findings were inconclusive (ATSDR 1997). Another study found an association between leukemia in women and exposure to TCE in drinking water. However, more studies in people are needed to establish the relationship between exposure to TCE and cancer.

b. 1,2-Dichloropropane

1,2-dichloropropane (DCP) is a colorless liquid VOC. It has a chloroform-like odor and evaporates quickly at room temperature. It is a man-made chemical; people are responsible for all releases of DCP into the environment. DCP is now used in the United States only in research and industry. Before the early 1980s, it was used in farming as a soil fumigant and was included in some paint strippers, varnishes, and furniture finish removers (ATSDR 1989).

The most sensitive route of exposure to DCP is through inhalation. Animal studies indicate that breathing low levels of DCP over long and short periods causes damage to the liver, kidney, and respiratory system. Breathing high levels causes death. Some studies indicate that ingesting DCP may cause reproductive effects. One study reported a delay in bone formation of the skull in fetal rats following exposure of the maternal rats to DCP (ATSDR 1989).

It is unknown whether DCP causes cancer in humans. The carcinogenicity of DCP has been studied in animals, mainly rats and mice. Liver tumors were observed in mice and mammary gland tumors have been observed in rats exposed to DCP. The International Agency for Research on Cancer (IARC) has determined that DCP is "unclassifiable as to human carcinogenicity."

2. Public Health Implications for Children and Adults

In this section, we discuss the public health effects of environmental contamination in Cheshire. To understand health effects that might be caused by a specific chemical, it is helpful to review factors related to how the human body processes such a chemical:

- the exposure concentration (how much),
- the frequency and duration of exposure (how long and how often),
- the route of exposure (breathing, eating, drinking, or skin contact), and
- the multiplicity of exposure (environmental media, routes of exposure, and combinations of contaminants).

Once exposure occurs, a person's individual characteristics (age, gender, diet, general health, lifestyle, and genetics) influence how their body absorbs, distributes, metabolizes, and excretes the chemical. Together, these factors determine health effects that exposed people might experience.

ATSDR's Child Health Initiative recognizes that the unique vulnerabilities of infants and children demand special emphasis in communities faced with water, soil, air, or food contamination. Children are at greater risk than are adults from certain kinds of exposures to hazardous substances emitted from waste sites and other uncontrolled releases. They are more likely to be exposed because they play outdoors and they can carry food into contaminated areas. They are usually shorter than adults, which means they breathe dust, soil, and heavy vapors close to the ground. Children are also smaller, resulting in higher doses of chemical exposure per body weight. The developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages. In this PHA, we evaluate a child's exposure to VOCs in drinking water. Exposure doses and risk estimates are calculated specifically for children.

CT DPH has taken into account when analyzing risk for health effects of TCE exposure that the most sensitive adverse noncancer health effects of TCE are developmental, *in utero* effects. CT DPH has also evaluated short-term (acute) exposure to the highest TCE level in drinking water, focusing on exposure to the developing fetus.

As discussed earlier in this document, the focus of this public health assessment is past groundwater contamination in the public and private water supply and cancer data in the town of Cheshire. VOCs were present at levels above current drinking water standards in the drinking water supply in the past. Ingestion of the water, as well as inhalation and skin contact with the contaminated water, are the exposure routes evaluated here.

a. Exposure Dose and Risk Calculations

Trichloroethylene

Public Water Supply

We were not able to estimate with certainty the contaminant levels and risk to which Cheshire residents were exposed before 1979, because we do not have enough sampling data. However, we can use the limited data that exist to make conservative estimates of exposure and risk. We used the following two scenarios to estimate exposure doses, exposure concentrations in water, and noncancer and cancer risks:

A) We assumed exposure began in 1974, when north Cheshire well #4 went into operation, and continued until 1989, when TCE levels fell below nondetectable levels.

Scenario A is more realistic than scenario B described below, because it assumes that exposure began in 1974 rather than 1959. It is unlikely that TCE contamination was present in drinking water as early as 1959 because many of the industries suspected of contaminating groundwater did not exist until the 1960s and 1970s. In addition, 1974 is a more realistic assumption about when exposure began because well #4, the most contaminated well in the north Cheshire well field, came online in 1974.

For each year of exposure between 1974 and 1989, an average TCE concentration was calculated using the available sampling data for that year. The overall TCE concentration that Cheshire residents were possibly exposed to (14 ppb) is the average of each annual TCE concentration from 1974–1989. We assumed that the overall estimated average TCE concentrations before 1979 were equal to the TCE concentrations in 1979 (see Appendix E and F for more details on exposure assumptions and calculations).

B) Exposure was assumed to begin in 1959, when the first groundwater well went into operation (north Cheshire well #1). Exposure was assumed to continue until 1989, when groundwater levels dropped to nondetectable levels. This scenario is more conservative (health protective) but probably less realistic than scenario A given the reasons above, because it assumes a longer exposure period. For each year of exposure between 1979 and 1989, we calculated an average TCE concentration using the available sampling data for that year. We assumed that average TCE concentrations before 1979 were equal to 1979's TCE concentrations. The overall estimated average TCE concentration that Cheshire residents were exposed to (13 ppb) is the average of each annual TCE concentration from 1959–1989. Scenario B is similar to scenario A except that it incorporates a much longer exposure period. Appendices E and F present more details on exposure assumptions and calculations.

In calculating exposure concentrations for TCE and DCP in Cheshire drinking water, CT DPH calculated average concentrations for each year rather than 95% upper confidence limits (UCLs). A 95% UCL provides a conservative estimate of the average concentration. A 95% UCL is unlikely to underestimate the "true" average. Using a 95% UCL is particularly important when there are not many environmental samples on which to base an estimate of the concentration to which people are exposed. When there are too few samples, an average concentration may significantly underestimate the true concentration to which people were exposed. For this Public Health Assessment, a reasonably large number of drinking water samples were available for each year. For this reason, CT DPH decided that it was not necessary to calculate 95% UCLs. CT DPH is confident that the average concentration it has calculated for each year provides a conservative estimate of the "true" average.

TCE exposure scenarios and their associated concentrations are found in Table 8.

Table 8. TCE Exposure Scenarios and Associated Concentrations

Scenario	TCE Concentration (ppb)	Exposure Duration (Years)
A	14	16
B	13	31

<u>Noncancer Effects</u>

<u>Chronic Effects</u>

To estimate noncancer effects, CT DPH used the average TCE concentration (for each scenario, A and B) and estimated the dose a child (age 1–6 years) would receive from 1) drinking contaminated water, 2) from inhaling TCE during bathing/ showering, and 3) through skin contact during bathing/showering. Noncancer risks are always calculated for a young child because the average dose a young child receives is greater than an adult's average dose. This is because a child's body weight is small, relative to his intake of food or water.

The noncancer risk calculations show that a child's exposure to TCE (under both scenarios A and B) could result in a Hazard Index (HI) of up to 10. An HI is the ratio between a person's exposure and the "safe" level. An HI of 10 means that Cheshire residents could have been exposed to TCE at levels 10 times higher than the "safe" dose. An HI greater than 1 means that a person's exposure is greater than the safe level and health effects cannot be ruled out. Detailed calculations are found in Appendix G.

By comparing estimated doses with toxicological and epidemiological effect levels reported to have produced health effects, we can better understand what this noncancer risk estimate means in terms of the likelihood of health effects. Table 12 compares estimated TCE exposures to people living in Cheshire with TCE effect levels from human and animal studies. The information provided in Table 12 is technical and very complex. It illustrates the difference between TCE levels people may have been exposed to while living in Cheshire and levels reported to be associated with cancer and noncancer effects in people and laboratory animals.

Table 9 shows doses of TCE levels that residents may have received in the town of Cheshire, using worst-case scenario assumptions. These exposure levels were estimated using very conservative (health protective) assumptions. Table 9 shows that for noncancer effects, TCE exposures Cheshire residents may have received are about 80,000–400,000 times lower than noncancer effect levels observed in animal and human studies. Therefore, we do not expect to see increased noncancer effects in Cheshire residents who drank the public water supply.

<u>Acute Effects</u>

Cheshire residents could have been exposed to high levels of TCE for short periods. We do not know for certain whether this occurred because we have no data on water concentration prior to 1979. Levels of TCE in raw water reached concentrations as high as 249 ppb in 1979. Therefore, an acute (short-term) TCE dose estimation was necessary to look for the possibility of noncancer health effects. A maximum TCE concentration of 249 ppb was used to calculate a dose that was 900–45,000 times lower than the levels seen to produce noncancer health effects from acute exposures in toxicological literature. Therefore, it is unlikely that a higher acute dose from exposure to the public water supply would produce any health effects.

<u>Cancer Effects</u>

CT DPH also calculated lifetime cancer risks to Cheshire residents using exposure assumptions from scenarios A and B (see Appendix G).

For estimating excess cancer risk, EPA typically provides a potency factor for an environmental contaminant, such as TCE. This potency factor (known as a slope factor or unit risk factor) is an upper-bound estimate of theoretical cancer risk for the general population for a lifetime of exposure to account for the possibility that potency may vary between individuals. Though it cannot be calculated, true excess risk to an individual is likely to be less than the calculated risk.

If a Cheshire resident were exposed to the public water supply every day, it would result in a maximum exposure of 0.0007 mg/kg/day. Using EPA's proposed cancer slope factor, the maximum theoretical cancer risk would be 3 in 10,000. This means that there might be three excess cancers in a population of 10,000 for Cheshire residents who drank the water every day for 31 years. Background rates of cancer in the United States are 1 in 2 or 3 (NCI 2001). This means that in a population of 10,000, background numbers of cancer cases would be approximately 3,300 to 5,000. This theoretical cancer risk estimate indicates minimal lifetime incremental cancer risk from exposure to TCE. Furthermore, our assumptions to estimate risk were very conservative. The true exposure is probably lower than what we calculated in the PHA. TCE dose and risk calculations are found in Appendix G.

To provide further perspective on what the cancer risk estimates mean, Table 9 shows doses of TCE levels that residents may have received in the town of Cheshire, using the worst-case exposure scenario (scenario B). These exposure levels were estimated using very conservative (health protective) assumptions. Table 9 shows that for cancer, TCE exposures Cheshire residents may have received are approximately 20–96,000 times lower than cancer effect levels observed in animal and human studies. While the lower effect level was only 20 times lower than estimated effects level seen in lifetime cancer risk from TCE in the public water supply, this effect level was seen only in one study (EPA 2001). It was not seen anywhere else in toxicology literature. In addition, the TCE levels present in the public water supply in Cheshire were never seen in toxicology literature to have caused cancer.

Cancer incidence rates in Cheshire do not appear to be elevated during the periods evaluated (see the Health Outcome Section of this document). Therefore, we do not expect to see increased cancer rates among Cheshire residents who drank the public water supply.

Table 9. Estimated Doses for TCE: A Comparison of Average Daily Doses (ADD) From Drinking Contaminated Water in Cheshire with Cancer and Noncancer Effect Levels From Toxicology Literature

<table>
<tr><th>TCE Dose from drinking water in Cheshire
(mg/kg/day)</th><th>Comment</th><th>Effect Level from the Literature</th><th>Comment</th></tr>
<tr><td>0.0007</td><td>Highest estimated LADD for cancer effects using worst case exposure scenario</td><td rowspan="2">33–67

0.5–3.1

5

0.014–1.4</td><td rowspan="2">Human equivalent LED_{01} based on kidney tumors, (EPA 2001) in rats exposed by ingestion.

Range of human equivalent LED_{01} values based on liver tumors in mice by ingestion and inhalation (EPA 2001)

LED_{01} for kidney cancer in German cardboard workers exposed by inhalation (EPA 2001)

Range of LED_{01} values for cancer (non-Hodgkin’s lymphoma, liver cancer, kidney cancer) in Finnish workers exposed to TCE and other solvents (EPA 2001).</td></tr>
<tr><td>0.006</td><td>Highest estimated LADD for cancer effects using highest private well concentration</td></tr>
<tr><td>0.003</td><td>Highest estimate ADD for noncancer effects using worst case exposure scenario</td><td rowspan="2">250–1160</td><td rowspan="2">LOAEL* for renal effects in rats. LOAEL for renal effects in mice (ATSDR 1997).</td></tr>
<tr><td>0.03</td><td>Highest ADD for noncancer effects using highest private well concentration</td></tr>
</table>

ADD=Average daily dose.
LADD = Lifetime average daily dose.
LED_{10} = Lower 95% confidence limit on the effective dose to 10% of the population.
LED_{01} = Lower 95% confidence limit on the effective dose to 1% of the population.
*Lowest-observed-adverse-effect level, which is the lowest dose in µg/kg/day in a toxicological study at which adverse effects occur.

Private Wells

As stated previously, TCE was detected in three private wells near Alling Lander and County Wide Construction. Each private well was sampled once. One well had TCE present at a concentration of

141 ppb. The other two wells had TCE levels approximately half as high. It is not known how long the wells were contaminated with TCE. It is also not known what the average TCE levels were that residents may have been exposed to over the long term.

Despite the lack of data, CT DPH used the information it had available to estimate theoretical cancer and noncancer risks. To calculate risks, CT DPH used the highest TCE concentration of 141 ppb and assumed residents were exposed to that concentration for 25 years. CT DPH selected 25 years as reasonable exposure duration because it was thought that some industries in the nearby area (Alling Lander/County Wide Construction or similar companies occupying the properties before Alling Lander/County Wide Construction) were established around this time. Exposure was assumed to stop in 1983, when residents were transferred to bottled water. However, residents were still using TCE-contaminated well water for bathing/washing until 1990, when they were connected to the public water supply. Therefore, there may have been additional TCE exposures from dermal contact and inhalation that continued until 1990. Even considering this possible additional exposure that was not assessed in the risk calculations, CT DPH still believes that 25 years is a conservative estimate of exposure duration.

Regarding the TCE concentration in the private well water, CT DPH does not know what concentrations people were exposed to over time. Because there is only one TCE measurement from each private well, at a single point in time, CT DPH cannot calculate an average concentration for the exposure period. CT DPH chose to use the highest measured TCE concentration of 141 ppb in the risk calculation. It is possible that TCE levels in the private wells were much higher than 141 ppb (shallow groundwater TCE levels at the adjacent Alling Lander and County Wide Construction sites were as high as 1,500 ppb). It is also possible that average TCE levels were much lower. Because of the lack of data, CT DPH considers the cancer and noncancer risk estimates presented below to be very uncertain.

Noncancer Effects

As stated above, CT DPH assumed that residents were exposed to 141 ppb. For noncancer risks, a dose was estimated for a child age 1–6 years. The estimated dose to a child was calculated to be 103 times higher than the “safe dose” (HI equal to 103). A HI greater than 1 means that a person's exposure is greater than the safe level and health effects cannot be ruled out. Detailed risk calculations are provided in Appendix H. To provide further perspective on the noncancer risk calculations, CT DPH compared the estimated dose with toxicological and epidemiological literature effect levels that were observed to have produced health effects. In comparing TCE doses that a child may have received from private well water with noncancer effect levels from the literature, we see that estimated TCE doses are 8,000 to 40,000 times lower than noncancer effect levels observed in human and animal studies (refer to Table 12). Therefore, even though estimated noncancer risks from TCE exposure are high (HI equal to 103), estimated doses are still well below adverse effect levels. However, we must stress that there is a large degree of uncertainty in the noncancer risk calculations because of the lack of data on TCE concentrations in well water. A single TCE measurement is not enough data on which to base a decision about whether TCE contamination in private wells was likely to result in adverse noncancer health effects. Therefore, CT DPH cannot reach a conclusion about whether exposure to TCE in private wells was likely to have resulted in adverse noncancer health effects.

Cancer Effects

To estimate theoretical cancer risks, CT DPH assumed that residents were exposed to TCE in their private well water for 25 years at a concentration of 141 ppb. Based on these assumptions, theoretical cancer risks could be as high as 3 in 1,000 (3×10^{-3}). A cancer risk of 3 in 1,000 means an excess of three cancers in 1,000 exposed persons. Background cancer rates in the United States are 1 in 2 or 3 (NCI 2001). This means that in a population of 1,000, the background number of cancers would be approximately 330 to 500. An excess cancer risk of 3 in 1,000 is considered to be a fairly substantial excess cancer risk. When we compare TCE doses that may have been received from private well water with cancer effect levels from the literature, doses from private well water are still slightly below effect levels (2–11,000 times below effect levels, see Table 12). However, cancer risks estimated here are highly uncertain because of the critical lack of data on TCE concentrations in the private wells. Because of the large uncertainty, CT DPH cannot conclude whether exposure to TCE in private well water was likely to have resulted in cancer effects.

1,2-Dichloropropane

Public Water Supply

We calculated an average DCP concentration using the maximum concentrations found in either raw or finished water in the south or north Cheshire well field in years 1983–1988 (6 years) and averaging those concentrations. The estimated average DCP concentration was calculated to be 6 ppb.

Noncancer Effects

To estimate noncancer effects, CT DPH used the average DCP concentration and estimated the dose a child (age 1–6 years) would receive from drinking contaminated water over a period of 6 years (1983–1988). Unlike TCE exposure, DCP exposure duration was well defined. We know from the sampling data that DCP contamination began in 1983 and ended in 1988. Therefore, alternative exposure scenarios were not necessary. Dose levels were compared to California EPA's reference dose of 0.089 mg/kg/day, which was based on an established a public health goal of 5 ppb for DCP in drinking water in 1999 (CALEPA 1999). Noncancer and cancer risk calculations can be found in Appendix G.

The noncancer risk calculations show that a child's exposure to DCP could result in a Hazard Index (HI) of 0.02. An HI is the ratio between a person's exposure and the "safe" level. An HI of 0.02 means that noncancer effects from DCP exposure are not likely. Therefore, we do not expect that there would be any increase in noncancer effects from DCP in Cheshire residents who were exposed to the public water supply. Detailed calculations are found in Appendix G.

Cancer Effects

CT DPH calculated a lifetime average daily dose for cancer risk assuming exposure duration of 6 years and an exposure concentration of 6 ppb. The average daily dose was multiplied by a cancer slope factor (potency factor) of 0.04 mg/kg/day $^{-1}$ (CALEPA 1999). The potency factor was based on a 2-year oral gavage study on mice that resulted in hepatocellular adenomas and carcinomas. The study was conducted by the National Toxicology Program (NTP 1986).

If a Cheshire resident were exposed to public water every day for 6 years, it would result in a maximum exposure of 0.002 mg/kg/day. Using the above cancer slope factor, the maximum theoretical cancer risk would be extremely low (4 in 1,000,000). This means that there might be four excess cancers in a population of 1,000,000 for Cheshire residents who drank the water every day for 6 years. Background rates of cancer in the United States are 1 in 2 or 3 (NCI 2001). This means that in a population of 1,000,000, background numbers of cancer cases would be approximately 330,000 to 500,000. In addition, the assumptions that were made regarding risk were very conservative (maximum, not average yearly DCP concentrations were used and averaged to calculate a DCP concentration) and it likely that the exposure is lower that what was assumed. Therefore, we do not expect that there would be any increase in cancer effects from DCP in Cheshire residents who were exposed to the public water supply.

TCE dose and risk calculations are found in Appendix G.

3. Health Outcome Data Evaluation

a. Analysis of Cancer Incidence in Cheshire

Methods for Analyzing Cancer Incidence

Cancer incidence data (reports of new cancer diagnoses) for the town of Cheshire for the years 1975–2000 were obtained from the Connecticut Tumor Registry (CTR). Seven cancer types, as well as all cancers combined (adults and children), were evaluated. The specific cancer types were: non-Hodgkin's lymphoma, liver, bladder, kidney, brain, leukemia, and breast. These types of cancer were selected for evaluation based on past concerns raised by residents and because of possible associations found in other studies between the contaminants found in drinking water and certain cancers. Only cases reported to the CTR as a primary cancer of the types being evaluated and diagnosed among a resident of Cheshire were included for analysis. Cases were selected on the basis of the address reported by the hospital to CTR at the time of diagnosis.

The CTR is a population-based surveillance system that began collecting information in 1935 on Connecticut residents diagnosed with cancer. It is the oldest tumor registry in the country. All newly diagnosed cancers among Connecticut residents are required by law to be reported to the CTR.

The 26 years of 1975–2000 constitute the period for which the most recent and complete cancer incidence data were available from the CTR. It includes the period when exposure from contaminated public water is likely to have been greatest. Most cancers take many years to develop after an exposure to a carcinogen, often between 10 and 30 years. This time from exposure to resulting disease is called a latency period. The 1975–2000 study period is likely to include latency periods, because most exposure to contaminated water stopped in 1987 with treatment of the public water supply. Cancer evaluations were conducted for three periods separately: 1975–1984, 1985–1994, and 1995–2000. This analysis of shorter time frames allows evaluation of patterns or trends in cancer incidence over time.

To evaluate whether a given cancer type is elevated for a given period, we calculate a standardized incidence ratio (SIR). An SIR compares the number of cancers reported in Cheshire to the number that would normally be expected from known statewide incidence rates for the cancer. An SIR greater than 1 indicates that there were more cases reported in Cheshire than expected, while an SIR less than 1 indicates that fewer than expected were reported. For example, an SIR of 1.5 indicates that 50% more cases occurred than were expected. Separate SIRs are usually calculated for each gender, where appropriate. To calculate SIRs, it is necessary to obtain population information for the entire state and for Cheshire. The population estimates used in this analysis were from the nearest decennial year of the U.S. census (1980, 1990, 2000). This allows an estimate of an "at-risk" population in Cheshire (by age and gender for each period) and to estimate statewide rates by age and gender for each cancer type.

Interpretation of Standardized Incidence Ratios (SIRs)

To determine if the number of cancer cases occurring in Cheshire were elevated, SIRs were calculated for the seven primary cancer types and for all cancer combined. The SIRs were calculated separately for the three periods, for adults and for children under age 19 (childhood Leukemia and all childhood cancers combined), and for males and females. The SIRs were adjusted to take into account the age distribution of the population in Cheshire.

Care should be taken in interpretation of SIRs due to statistical variability. As a measure of statistical variability, "95% confidence intervals" are presented for each SIR. The size of the 95% confidence interval depends on the number of cases. For small numbers of cases, the range of the confidence interval will be larger than for cancer types with a large number of cases. An SIR is considered statistically significant if the 95% CI does not include the value 1. Statistically significant means that there is less than a 5% chance that the observed difference is the result of random fluctuations in the number of cases. An SIR that is statistically significant *does not necessarily indicate a finding is of public health relevance.* Statistically significant SIRs can still occur due to random variation. For example, when using the 95% confidence limit, one would expect one out of 20 calculated SIRs to be significant due to random variation alone. In the Cheshire analysis, a total of 57 SIRs were calculated, so up to three SIRs would be expected to be elevated by chance alone.

In evaluating the public health significance of elevated SIRs (those greater than 1.00), a number of factors are considered. The magnitude of the SIR elevation is an important finding. For example, an SIR of 5.00 (500% increase) is much more suggestive of an important finding than an SIR of 1.5 (50% increase). The size of the confidence limit reflects the stability of the SIR estimate. A narrower confidence interval, such as 1.1 to 1.2, indicates the calculated SIR is more precise than a SIR that has a large confidence interval.

Trends over time also should be considered in evaluating SIR. Because we evaluated three periods for Cheshire, we can look at consistency over time. For a few cancers, such as breast cancer, incidence rates are higher in wealthier socioeconomic groups. The association between socioeconomic status and breast cancer is due, at least in part, to differences in fertility and reproductive history. Most other known risk factors for cancer (smoking, occupation, diet) are not available for evaluation on a town or statewide basis. Socioeconomic and racial factors can be taken into account, but this is not routinely done for SIRs.

Results of Cancer Analysis

The following section presents the results of cancer incidence in Cheshire for the period 1975–2000, broken down into three periods: 1975–1984, 1985–1994, and 1994–2000. Tables 8, 9, and 10 contain the SIRs for the three periods, broken down further by male and female.

During the periods evaluated, cancer incidence occurred at or near the expected rate for the cancer types and categories evaluated. Some SIRs were higher or lower, but most were not at the level of statistical significance. The exceptions included elevated SIRs for “all invasive cancers” combined for females (1985–1994), non-Hodgkin’s lymphoma for females (1975–1984), brain cancer for females (1985–1994), and breast cancer in females (1995–2000). The SIR for males for all cancers combined (1985–1994) was significantly less than expected.

These statistically significant differences need to be looked at more closely because, as stated earlier, the finding of an SIR greater than 1.00 does not necessarily mean a finding of public health significance.

A SIR of 1.10 suggested a small, yet statistically significant increase in all invasive cancers for females (1985–1994). This finding was statistically significant, in part due to the large overall numbers of all cancers being counted, resulting in a narrow confidence interval of 1.02–1.99. The only specific cancer evaluated during this period that was statistically significantly elevated was brain cancers in females (7.3 cases expected, 16 cases observed). This excess number of brain cancers is not likely enough to result in the statistical significance of the “all invasive” category.

The incidence of non-Hodgkins lymphoma in females was statistically significantly elevated for the period 1975–1984. Judging from state rates, 12 cases would have been expected in Cheshire during this 10-year period, but 20 cases were observed (SIR 1.67). This increased SIR for non-Hodgkins lymphoma in females was not consistently elevated over time. The 1984–1994 period SIR was lower at 1.31 and was not statistically significant. For the most recent period (1995–2000), the SIR was lower than expected (SIR=0.67).

Breast cancer was slightly elevated in the first two periods, but not at the level of statistical significance. During the most recent period (1995–2000), breast cancers in females reached statistical significance (SIR=1.27), represented by 37 cases more than expected. The potential public health significance of this and other findings is covered later in the “discussion” section.

Childhood cancers overall and childhood leukemia are of specific interest to some residents of Cheshire. This current evaluation did not find significant excess in either of these cancer types/categories. These analyses are complicated by very small numbers in each time period. For example, only 2.5 cases of pediatric leukemia are expected over the 10-year periods (1974–1985, 1985–1994). So, even though there are more than expected numbers of leukemia in boys for 1974–1985 (4 observed vs. 1.5 expected), the confidence limits are large and do not indicate statistical significance. Female pediatric leukemia cases for the same period was zero, when one case would be expected. These numbers only highlight the problems with statistical stability when a very low number of cases is involved. There was also no apparent time trend in pediatric leukemia, with numbers of cases being highly variable between the three periods evaluated. There was no apparent increase or decrease over time in the small number of pediatric leukemia observed (1975–1984, n=4, 1985–1994, n=4, 1995–2000, n=2).

Overall childhood cancers were not statistically significant for any of the periods. Evaluation of this category of cancers is also constrained by the very small numbers that occur over a period of 10 years. There was a trend of increasing SIRs for male and female childhood cancer over the three periods, with the largest SIR being 2.00 for boys in the 1995–2000 period. However, this doubling of the expected numbers is represented by nine cases over a 5-year period, resulting in large confidence limits that do not indicate statistical significance.

Table 10. Cheshire SIRs for the Years 1975–1984

	SIR	95% CI	Observed Cases	Expected Cases
All Invasive Cancers				
Females	0.95	0.86–1.05	394	412.77
Males	0.94	0.85–1.04	376	401.06
Non-Hodgkin's Lymphoma				
Females	1.67	1.02–2.57	20	11.99
Males	1.28	0.73–2.07	16	12.55
Female Breast	1.01	0.84-1.21	120	118.76
Liver				
Female	0.00	—	0	1.53
Male	1.36	0.37–3.48	4	2.94
Bladder				
Females	0.86	0.42–1.59	10	11.56
Males	1.11	0.78–1.57	34	30.69
Kidney				
Females	1.40	0.56–2.88	7	5.00
Males	0.87	0.37–1.71	8	9.24
Brain				
Females	1.05	0.38–2.28	6	5.74
Males	1.24	0.57–2.36	9	7.25
Leukemia				
Females	0.74	0.32–1.45	8	10.86
Males	1.02	0.56–1.71	14	13.72
Pediatric Leukemia (0–19 years)				
Females	0.00	—	0	0.99
Males	2.61	0.71–6.68	4	1.53
All Pediatric Cancers (0–19 years)				
Females	0.83	0.23–2.12	4	4.82
Males	1.23	0.53–2.43	8	6.48

Table 11. Cheshire SIRs for the Years 1985–1994

	SIR	95% CI	Observed Cases	Expected Cases
All Invasive Cancers				
Females	1.10	1.02–1.99	643	585.20
Males	0.89	0.82–0.97	524	586.42
Non-Hodgkin's Lymphoma				
Females	1.31	0.87–1.91	28	21.30
Males	1.02	0.66–1.51	24	23.48
Female Breast	1.14	0.99–1.31	208	182.68
Liver				
Female	0.50	0.01–2.77	1	2.01
Male	0.56	0.12–1.64	3	5.35
Bladder				
Females	1.10	0.65–1.74	18	16.30
Males	0.90	0.65–1.23	40	44.65
Kidney				
Females	1.35	0.70–2.37	12	8.88
Males	0.87	0.46–1.48	13	14.99
Brain				
Females	2.19	1.25–3.55	16	7.30
Males	1.32	0.70–2.26	13	9.83
Leukemia				
Females	1.44	0.87–2.55	19	13.18
Males	1.11	0.67–1.74	19	17.07
Pediatric Leukemia (0–19 years)				
Females	1.81	0.22–6.54	2	1.10
Males	1.30	0.16–4.70	2	1.54
All Pediatric Cancers (0–19 years)				
Females	1.62	0.65–3.33	7	4.33
Males	1.35	0.65–2.48	10	7.41

Table 12. Cheshire SIRs for the Years 1995–2000

	SIR	95% CI	Observed Cases	Expected Cases
All Invasive Cancers				
Females	1.05	0.96–1.16	449	426.6
Males	0.92	0.83–1.01	403	439.6
Non-Hodgkin's Lymphoma				
Females	0.67	0.33–1.20	11	16.4
Males	1.04	0.63–1.60	20	19.3
Female Breast	1.27	1.09–1.49	170	133.4
Liver				
Female	0.00	——	0	1.7
Male	0.89	0.24–2.27	4	4.5
Bladder				
Females	1.13	0.62–1.90	14	12.4
Males	1.21	0.88–1.67	40	33.1
Kidney				
Females	0.94	0.38–1.93	7	7.5
Males	0.89	0.44–1.59	11	12.4
Brain				
Females	0.86	0.23–2.19	4	4.7
Males	0.91	0.33–1.98	6	6.6
Leukemia				
Females	1.14	0.55–2.09	10	8.8
Males	1.06	0.57–1.82	13	12.2
Pediatric Leukemia (0–19 years)				
Females	0.00	—	0	0.8
Males	1.94	0.24–7.02	2	1.0
All Pediatric Cancers (0–19 years)				
Females	1.47	0.48–3.42	5	3.4
Males	2.00	0.92–9.87	9	4.5

Discussion

The public health significance of the results described above, needs to be evaluated with an understanding of the limitations of epidemiology, known risk factors for specific cancers, and known environmental contamination in Cheshire.

Cancer is not a single disease. Studies have generally shown that different cancer types have different causes, patterns of incidence, risk factors, and latency periods (the span between exposure and development of disease). Therefore, each of the cancer types evaluated should be viewed as separate issues. If there were a common environmental exposure resulting in elevated cancer risk in Cheshire, it would have likely affected the incidence of only one cancer type.

The type of cancer analysis conducted in this Health Assessment is often referred to as an "ecological analysis." It looks at cancer over a broad area and does not take into account individual characteristics of cases. As such, ecological analyses have a number of limitations that prevent drawing cause and effect conclusions. This type of analysis is most often used to identify areas where more detailed studies are needed. It cannot determine what may have caused an individual's cancer nor whether an observed incidence increase in the community is or is not related to a specific environmental contamination.

Another important factor in interpreting the results of this analysis is the fact that many cancer types and time periods were evaluated. All together, 57 separate SIRs were calculated for the different categories of cancer and different periods. From a statistical perspective, conducting many analyses such as these will result in some number of statistically significant results through chance alone. Although there are statistical methods to control for multiple comparisons, we did not use those in this analysis so that the results would be more conservative (more likely to show an effect). However, when viewing Tables 1, 2, and 3, the issue of multiple comparisons should be kept in mind.

Breast Cancer

Breast cancer in females had a statistically significantly elevated SIR for the period 1995–2000 (SIR=1.27). This means there was a 27% excess in the number of cases over what would be expected from the statewide incidence of breast cancer. In the 1985–1994 period, the SIR was 1.14 and was almost statistically significant. During the earliest period, the breast cancer SIR was 1.01, meaning the incidence was almost exactly what would be expected. The fact that breast cancers were elevated for two consecutive periods supports the idea that the elevation was not due to random variation in the numbers. In addition, the total number of cases observed in each period was relatively large (170 and 208), leading to relatively more stable estimates and smaller confidence limits.

Breast cancer is the most common form of cancer in females in Connecticut and nationally. Rates of breast cancer have been increasing in recent decades and this trend is mirrored by the data for Cheshire. The reason for the increase nationally is not clearly understood. It may, in part, result from better detection through mammography, as much of the increase has been for early stage tumors. However, the increase cannot be fully explained by increased use of mammography, suggesting that changes in other breast cancer risk factors may also be occurring.

Both genetic and environmental factors are believed to play a role in a woman's risk of developing breast cancer. Family history is one of the strongest factors, indicating a genetic link. Another strong determinant is a woman's age at first full-term pregnancy. Women who have a first full-term pregnancy after age 30 years and women who have never given birth have about a 2-to-3 fold increased risk of breast cancer compared to women who have a full-term pregnancy before age 20 years. These reproductive factors are thought to affect the risk of breast cancer by their effects on a women's hormonal status, especially total lifetime estrogen levels.

Higher socioeconomic status has also been identified as a risk factor for breast cancer (Burke et al. 1997). It is thought that socioeconomic status risk factors may be indirectly related to breast cancer risk by affecting the average age at first full-term pregnancy (Baquet et al. 1991). The potential effects of socioeconomic factors may help explain at least part of the observed increased risk in Cheshire. When socioeconomic factors are included in an evaluation of town rates of breast cancer, the incidence in Cheshire is no longer statistically significant (Polednak 2003). This does not mean the observed increase is not real, but rather provides one explanation as to why the increase was observed.

Other potential risk factors for breast cancer include increased age; long-term oral contraceptive use; increased weight, dietary fat, and other dietary factors; and alcohol consumption. It is uncertain if any of these factors would preferentially affect breast cancer risk in Cheshire.

Very few environmental factors have been strongly associated with breast cancer. High doses of ionizing radiation, especially during younger years, is known to increase the risk of breast cancer. No firm associations have been documented between environmental chemical exposures and the risk of breast cancers. Some epidemiology studies suggest a potential link with chemicals that have structures similar to estrogen, sometimes called environmental estrogens (DDT, PCBs, other pesticides, and some plastics).

TCE—the primary compound of concern in Cheshire—has in general not been associated with breast cancer through human or animal studies. TCE has been associated with other cancer types (liver, kidney, leukemia, lymphoma). Although there is an apparent increase in breast cancer in Cheshire in recent periods, it is not likely due to past water contamination with TCE or any other potential past environmental issues in town.

All Invasive Cancers

All invasive cancers combined for females in the period 1985–1994 were significantly elevated with an SIR of 1.10 or 10% greater than expected number. This finding was not consistent across periods. In the earlier period (1975–1984), there were fewer than expected cases. In the most recent period there was a small elevation, though not statistically significant. It is likely that this increase during one period, for a single gender, reflects random variation in the number of cases. As stated earlier, cancer is not a single disease. Therefore, if there was an environmental influence on cancer in Cheshire, it would unlikelyaffect a single cancer type. Also for most carcinogens, similar effects would be expected in both genders. For example, the total number of cancers for males is less than expected for all three periods. Therefore, it is unlikely that this finding for female cancers is related to an environmental exposure.

Brain Cancers

Brain cancer in females was elevated for the 1985–1994 period, with moderately elevated SIR of 2.19. There were 16 cases observed, and 7.3 were expected. This finding was not repeated in the earlier or later period, and therefore, does not likely represent a significant trend in brain cancer cases. The finding was also not observed in males during any period. Brain cancers have been associated with certain occupational exposures and with occupational exposure to electromagnetic fields from high voltage power lines (NIEHS 2002). Little evidence exists to associate brain cancer with TCE exposure in water.

Non-Hodgkins Lymphoma (NHL)

Non-Hodgkins lymphoma (NHL) was elevated in females for the period 1975–1984, with an SIR of 1.67. This finding was not consistent between both genders or across the three periods studied. NHL has been associated with certain environmental exposures. In New Jersey, NHL was associated with TCE exposure in drinking water, but such associations are weakly suggestive at this point. This effect was seen in both males and females (Cohn et al. 1994). This finding has not been repeated in other studies and is deemed to be suggestive, but not conclusive (ATSDR 1997). Various occupational studies have indicated a potential association between inhalation of TCE and increased risk of NHL.

Childhood Leukemia

Studies in Woburn, Massachusetts, reported an increased risk of childhood leukemia in offspring of mothers who drank TCE-contaminated water during pregnancy (MASSDPH 1997). This finding was also found in the New Jersey study that looked at exposed populations from a number of communities (Cohn et al. 1994). A study in Dover Township, New Jersey, found an increase in female childhood leukemia among girls whose mothers drank water contaminated with TCE and other chemicals during pregnancy (NJDHSS and ATSDR 2003). However, due to limitations of these studies, including exposure to mixtures of chemicals, the association found is suggestive but not conclusive (ATSDR 1997). In Cheshire, SIRs for childhood leukemia incidence never reached the level of statistical significance. Individual SIRs were slightly elevated, but the total numbers of cancers were very small and do not indicate a consistent trend.

Childhood Cancers

Childhood cancers overall were not statistically significantly elevated. However, there was a trend over time of increasing SIRs, with the highest being 2.00 in boys during the most recent period (1995–2000). To see if any particular cancer type was causing this elevation, the CTR was asked to identify which cancers were found in children younger than 19 years. This analysis showed no consistent pattern, with a number of different cancers contributing to the overall total. For example, for boys during the 1995–2000 period, the nine cases can be broken down as follows: two leukemias, two testes, one melanoma, one oral, two colon, and one listed as “other.” In most cases, leukemia was the most common childhood cancer. As discussed earlier, the incidence of leukemia is not consistently nor statistically significantly elevated. Children born after 1989 did not have exposure to contaminants from the public drinking water, so any observed increase in cancer incidence during the recent periods are not likely to be related to this source.

Summary

Overall, there does not appear to be significant elevations in cancer incidence in Cheshire. Of the 57 comparisons conducted, only four were statistically significantly elevated. Among these four elevations, the strength of the effect was low, with SIRs near or less than 2 (highest = 2.19 for female brain cancer, 1985–1994). The number of statistically significant findings is close to what would be expected, given the number of SIRs calculated. For most of the elevations found, there were no time trends found, except for an increasing trend in all childhood cancers combined. Small numbers of cases in many categories, especially childhood cancers, resulted in unstable SIRs with large confidence intervals, that resulted in a lack of statistical significance.

TCE, the primary contaminent historically found in the Cheshire water system, has been associated with some of the cancers evaluated here. Non-Hodgkins Lymphoma and leukemia have been associated with TCE exposure in human studies and are therefore biologically plausible outcomes in Cheshire. However, the SIRs calculated for these two tumor types are not consistently, nor strongly elevated during the time periods considered. Breast cancer has not been associated with TCE exposure, so the elevation in this cancer during the most recent period is not likely a result of environmental exposure.

Limitations

There are a number of methodological limitations that must be considered when looking at the conclusions of this analysis. This assessment attempted to analyze cancer data for Cheshire on a town-wide basis to determine if the patterns of occurrence for selected cancers were unusual. Results from such an analysis cannot conclude with certainty whether an observed elevated cancer rate is or is not related to a common cause, such as the environment. Rather, this type of analysis can generate hypotheses that could be investigated by more definitive methods. Conversely, negative findings cannot with certainty conclude that the observed cancers are not related to environmental factors. In addition, this type of analysis cannot determine what may have caused any one individual’s cancer. Cancers, in general, have a variety of risk factors that could not be evaluated in this report. It is believed that many cancers are related to behavioral factors, such as smoking, diet, and alcohol consumption. Other factors include socioeconomic status and genetics.

The cancers evaluated in this report are only those reported to the Connecticut Tumor Registry (CTR). The CTR has been part of the National Cancer’s Institute’s Surveillance Epidemiology and End Results (SEER) Program since its inception in 1973. The SEER Program provides high quality data, and according to SEER-sponsored audits of hospitals, 98% of cancers are ascertained by SEER registries. However, the CTR will not have cases recorded for those people who moved out of Cheshire and were diagnosed after moving. This limitation is unavoidable in the type of analysis conducted here. However, it is also true that people who recently moved into Cheshire and were subsequently diagnosed with cancer are included in this analysis. These two processes of people moving into town while others are moving out should not result in a major difference in cancer incidence rates estimated for Cheshire and therefore, should not affect the results or conclusions.

4. Summary of Public Health Implications and Health Outcome Data

CT DPH evaluated noncancer and cancer risks from exposure to TCE and DCP in the public water supply in Cheshire. It also evaluated the risks from TCE in three private wells near the Alling Lander/County Wide Construction sites that were found to have levels above current state and federal drinking water standards. CT DPH found that, for the public water supply, noncancer and cancer risks from TCE and DCP were minimal. In addition, the TCE doses estimated for noncancer and cancer risks were below the effect levels seen in toxicological and epidemiological literature that were found to cause adverse health effects. This is supported by analysis of cancer data for Cheshire during the years 1975–2000. The evaluation of cancer incidence data shows that there are no significant elevations in cancer incidence in Cheshire that can be associated with TCE exposure.

CT DPH found that theoretical cancer and noncancer risks from the highest concentrations of TCE found in the three private wells were elevated. However, the estimated risks are extremely uncertain because they are based on a single sample result. CT DPH was not able to make a good estimate of average concentration people may have been exposed to over time. Therefore, CT DPH is not able to conclude whether TCE in private well water is likely to have posed a health threat in the past.

E. Community Health Concerns

1. History of Community Concerns

Newspapers have been the primary source of information for the residents of Cheshire. Cheshire residents have been concerned about environmental contamination in the public water supply since the late 1980s. The Regional Water Authority discussed the building of the aeration towers to treat the water contaminated with VOCs in the mid- to late-1980s. Renewed concern about the VOC contamination occurred in 1999 that grew from discussions of current and past VOC contamination in a Cheshire consumer confidence report by the RWA in 1998. The report was released as part of new laws requiring utility companies to disclose information to the public in more detail. This information was published in several articles by the *Cheshire Herald* (Cheshire Herald 1987 and 1999).

Beginning in the early 1990s, concerns about cancer and the environment in Cheshire increased significantly. Residents were mainly concerned with perceived elevated breast and childhood cancer rates and their relation to environmental exposures. Accordingly, some local legislative leaders and town council members became involved in an effort to push for an investigation about environmental contamination and whether it resulted in increased cancer rates in the town.

A citizens' group, Citizens Concerned about Cancer in Cheshire (CCCC), formed in the summer of 2002, in response to the increased cancer concerns in the town. The petitioner and another former resident set up a local website entitled "Cancer in Cheshire" (http://www.cancerincheshire.com/) to raise awareness about cancer and environmental concerns in Cheshire. In addition, the website set up a survey to solicit information about cancer cases from individuals in the town. The results of the survey were given to CT DPH, but the agency was unable to use the survey because of incomplete data. To analyze cancer incidence rates in Cheshire, it is necessary to use the best dataset available. The Connecticut Tumor Registry routinely collects all of this information as part of its federal grant with the National Cancer Institute and is the best source of information for cancer incidence. Consequently, that data is used for the Health Outcome Data Section of this document.

CT DPH became involved with cancer concerns and their possible relation to environmental exposures from industrial sites and the public water supply in Cheshire in October 1994 in response to citizen's inquiries. CT DPH drafted a response in March 1995, which included cancer rates and concluded that only breast cancer rates were somewhat elevated from 1983–1991, but the results were not statistically significant. More letters of concern from Cheshire residents to the Chesprocott Health Department, the governor's office, and CT DPH followed, until 2002, when CT DPH began this PHA. In addition, from 1994 to 2002, the Connecticut Tumor Registry became involved in several inquiries from CT DPH, Division of Environmental Epidemiology and Occupational Health (EEOH), about cancer rates.

2. Community Advisory Panel

The town of Cheshire, with assistance from CT DPH and CCCC, established a Community Advisory Panel (CAP) in the fall of 2002. CAP has advised CT DPH of the concerns and needs of the citizens of Cheshire on environmental issues in the community and assisted in community involvement and educational activities. The Cheshire CAP group includes residents from varying backgrounds within the community. It also includes three town council members and several members from CCCC. ATSDR, the South Central Connecticut Regional Water Authority (RWA), and CT DPH have conducted presentations regarding contamination, the PHA process, and epidemiological protocol to the CAP. Examples of presentations include groundwater contamination data by the RWA and a presentation of cancer epidemiology by an ATSDR representative. CT DPH has also presented updates on the Cheshire PHA, needs assessments, and waste sites of concern in Cheshire. The CAP has had 10 meetings to date, usually on an almost monthly basis, eight of which CT DPH has attended.

3. Needs Assessment Survey

a. Methods

The Connecticut Department of Public Health (CT DPH), with assistance from the federal Agency for Toxic Substances and Disease Registry (ATSDR) conducted a community needs assessment for Cheshire. A needs assessment is a process by which the “needs or concerns” of a specific population are collected and evaluated. The Cheshire Needs Assessment Survey had a number of purposes:

1) to gather community health concerns,
2) collect additional information about potential sources of hazardous waste contamination, and
3) to find out the best ways of communicating the results of our work to the public.

The results of this needs assessment are summarized below. A more detailed summary of this report as well as a questionnaire are included in Appendices I and J.

EEOH staff, in conjunction with ATSDR and the Cheshire CAP, developed the survey questionnaire collaboratively. The survey questionnaire was printed with a fact sheet describing the PHA process, and included a postage-paid return envelope to increase the response rate. The questionnaire was then distributed as an insert in a local weekly newspaper, the *Cheshire Herald*. Approximately 8,000 copies were distributed. In addition, copies of the survey were distributed and collected at the senior center, library, and the town hall in Cheshire. The completed surveys were then entered into a Microsoft Access database for analysis.

b. Findings

In total, 267 people completed the community concerns survey questionnaire of which ninety-eight percent were current residents of the town of Cheshire. The average length of residence in Cheshire is about 19 years, as reported by the respondents. Sixty-one percent of the residents are currently living with their children. About 42% of the children were 10 years or younger, 31% were between the ages of 10 to 15 years and 27% of the children were 15 years and older.

An overwhelming majority of residents (92%) expressed interest in learning more about contaminants found in the drinking water and about health outcomes such as cancer. In addition, there was a large concern over chemicals found in waste sites in Cheshire and whether exposure to them would increase adverse health effects. Residents of Cheshire are specifically concerned about cancer incidence rates and clusters. Residents were also concerned with all of the waste sites or "suspected sites" in Cheshire, and mostly concerned about the Cheshire municipal landfill (16%). Twenty-seven percent were concerned with other sites not specifically listed in the needs assessment. The most common other environmental concerns were groundwater contamination (20%) and pesticides (19%), followed by types of cancer and associated risk of living in Cheshire (10%).

When asked how the residents would like to receive the information about the Cheshire public health assessment process, 76% preferred the information by mail and 77% wanted information to be published in the newspapers. Only 15% wanted the information to be presented in community meetings. Cable or television as source of information was preferred by only 14% of the residents. A small percentage (7%) of the respondents wanted to get this information by email.

Another finding is that many of the residents did not feel that the local, state, or federal government has been responding to environmental concerns appropriately (40%, 43%, and 48% respectively). Many of the residents believe that environmental issues were of low priority with the government, but are happy that something is finally being done (i.e., the ATSDR Public Health Assessment).

CT DPH has responded to requests about learning more about contaminants in drinking water and health outcome data, such as cancer, by addressing them in the PHA. In addition, CT DPH held one public availability session in June 2003 and another in the spring of 2004 to address environmental concerns of the Cheshire community. Fact sheets about various environmental issues (cancer informational fact sheets, cancer clusters, TCE, etc.) were also distributed at the sessions. CT DPH has also met with the Cheshire CAP group and addressed many of their environmental and cancer concerns. CT DPH will continue to meet with the Cheshire CAP group to address these concerns. The initial release of this document in the spring of 2004, included a press release for distribution to the media. In addition, a fact sheet concerning the results of the Cheshire PHA was slated for distributiond at the Public Availability Session.

4. Public Availability Session

A public availability session (PAS) was held June 24, 2003, to allow Cheshire residents to ask questions about the Cheshire PHA and any community concerns. In addition, they were given the opportunity to fill out the needs assessment questionnaire. Representatives from CT DPH, Chesprocott Health District, Cheshire CAP, and the RWA were available at the PAS to answer questions from the Cheshire residents. About 13 Cheshire residents attended the PAS.

5. Evaluating Community Concerns

The following are the main concerns expressed by the residents of Cheshire, along with CT DPH's response.

a) Residents are concerned that the contaminated drinking water in the past may have contributed to higher than expected levels of cancer, especially breast and childhood cancers.

While residents were exposed to elevated levels of TCE and DCP in the past, there is no indication that cancer rates in Cheshire are significantly elevated. CT DPH found that noncancer and cancer risks from TCE in the public water supply were minimal. This is supported by an analysis of cancer rates that were not significantly elevated, except for breast cancer. While breast cancer was slightly elevated in Cheshire compared to state rates, exposure to TCE has not been found to be related to breast cancer.

b) Residents are concerned that the public water supply in Cheshire is currently contaminated.

While the public water supply in Cheshire currently contains low levels of VOCs, the water is treated via aeration towers to nondetectable levels before it reaches the public and is safe.

c) Residents of Cheshire are concerned with the 16 CERCLIS sites and whether they pose a health risk.

Most of the CERCLIS sites have been cleaned up and no longer pose a health risk. A few sites still have low levels of contaminants onsite and may pose a health risk to trespassers because of soil and shallow groundwater contamination. DEP and EPA have facilitated the cleanup of several of these sites and have currently set up monitoring systems for many of them. Furthermore, even if the shallow groundwater is contaminated by these sites, they are unlikely to affect the public water supply wells because of their distance from the wells. In addition, the RWA has a monitoring system in place that would detect any contaminant present.

Alling Lander may also pose a safety risk from the broken glass in the building on the property.

d) Residents are concerned about exposure to pollutants in the air from sites in Cheshire.

No data is available indicating exposure from pollutants in the air. In addition, it is difficult to measure outdoor air quality because of air dispersion properties, unless there is a visible plume present. Some Cheshire residents have been concerned about odors from Dalton Enterprises, but the Air Bureau of CT DEP has not cited Dalton for any odor violations.

F. Conclusions

Environmental sampling data indicate that the public water supply in Cheshire was contaminated with TCE and DCP from the years 1979–1989. Levels of TCE in the public water supply exceeded current MCLs, established in 1994 (federal drinking water standards) for several years in the late 1970s and early 1980s. The water may have been contaminated as early as 1959, but we do not know for certain because we have no sampling data before 1979. Levels of DCP also exceeded the MCLs for several years during the 1983–1988 period. Levels of DCP and TCE were reduced to levels significantly below the MCLs after the aeration towers were built in 1987 (north Cheshire well field) and 1985 (south Cheshire well field). In addition, three private residential wells were contaminated with elevated levels of TCE near the Alling Lander/County Wide Construction properties.

Using conservative estimates of exposure, CT DPH calculated noncancer and cancer risks to residents who drank water contaminated with TCE from the public water supply. CT DPH evaluated two exposure periods. The first scenario assumed that residents drank contaminated water from 1974–1989 (16 years). The second scenario assumed that residents drank the water from 1959–1989 (31 years). The cancer risk estimates for the two scenarios represent minimal increased risk above background cancer risks. The exposure duration in the worst-case scenario (31 years) is a very conservative estimate. CT DPH believes that the true exposure duration was closer to 16 years than 31 years. This means that it is more likely that Cheshire residents' increased cancer risks were minimal. More importantly, the highest TCE doses we estimated for Cheshire residents are still below the doses in the toxicology and epidemiology literature that have been observed to cause cancer. This is supported by the health outcome data, which do not indicate elevated cancer rates in Cheshire that can be related to exposure to TCE in the public water supply. This leads CT DPH to conclude that although Cheshire residents were exposed to TCE in the public water supply in the past, it is unlikely that the exposure has resulted in increased cancer rates in Cheshire.

With regard to noncancer risks from TCE exposure, estimated doses to Cheshire residents (for both scenarios) exceeded the "safe dose" by about 10 times. This means that the possibility of adverse noncancer health effects cannot be ruled out. However, estimated TCE doses to Cheshire residents were still well below levels in the toxicology and epidemiology literature that have been observed to cause noncancer effects. In addition, acute (short-term) exposure to the highest concentrations of TCE measured in the public drinking water supply was still below noncancer effect levels from the literature. This leads CT DPH to conclude that exposure to TCE in the past is unlikely to have caused noncancer health impacts in Cheshire.

Using conservative estimates of exposure, CT DPH also estimated noncancer and cancer risks to residents who were exposed to DCP in the public water from 1983–1988. The cancer risk estimates represent an extremely small increased risk from exposure to DCP. This risk estimate is conservative because the average yearly estimates of DCP that are used in risk calculations are based on maximum concentrations each year. It is likely that a Cheshire resident would be exposed to less than a maximum yearly concentration. This is supported by the health outcome data, which do not indicate elevated cancer rates in Cheshire that can be related to exposure to DCP in the public water supply. (Liver tumors have been observed in rodents exposed to DCP, as described in the section, D. DISCUSSION, 1. Chemical Specific Information, b. 1,2 Dichloropropane of this document.) With regard to noncancer effects from DCP, the estimated dose to Cheshire residents was significantly below the safe dose.

CT DPH has concluded that exposure to TCE and DCP in the public water supply in Cheshire presented *No Apparent Public Health Hazard* because of past exposures. That conclusion is based on the cancer and noncancer risk estimates, the comparison of doses to literature effect levels, and the review of cancer rates.

Even so, it was and is still necessary and appropriate for the RWA to have taken action to reduce contaminant levels in the public water because TCE and DCP levels exceeded health-based guidelines in effect at that time. Furthermore, the RWA's actions drastically reduced future exposures to contaminants in the water supply. Had the RWA not taken action, Cheshire residents would have received much greater exposures, which could have resulted in increased disease in the community.

TCE was also present in private wells of three households in Cheshire. CT DPH evaluated doses and risks from exposure to TCE using the highest level measured in private well water (141 ppb) and a conservative estimate of exposure duration (25 years). If TCE was actually present in private wells at this level (or higher) for 25 years, exposures to private well water could have presented a public health hazard in the past. Alternatively, it is possible that CT DPH's evaluation has greatly overestimated actual TCE exposures from private well water. In this case, exposure to private well water would not have presented a public health hazard in the past. CT DPH's dose and risk estimates for TCE in private well water are highly uncertain because the private wells were sampled only once. This means there is no information about average TCE concentrations that residents may have been exposed to over time. There also is no information regarding when TCE contamination first appeared in private wells in Cheshire. Therefore, any conclusions about the public health threat from past exposure to TCE in private wells in Cheshire are highly uncertain.

G. Recommendations

1) CT DPH and the Chesprocott Health Department should continue to work with the community leaders to educate them about specific environmental issues, such as pesticide use, private well issues, etc., in the town of Cheshire to avoid unnecessary exposures.

2) CT DPH, CT DPH (Drinking Water Division), and the South Central Connecticut Regional Water Authority (RWA) should continue to work together to ensure that the public water supply is safe. The RWA should continue to monitor the water supply for contaminants, especially VOCs.

3) CT DEP, RWA, CT DPH (Drinking Water Division), and EPA should continue to monitor the remaining 12 CERCLIS sites to ensure that any groundwater contamination immediately beneath the site is not leaching into the public water supply or any nearby private wells. In addition, any sites with contaminated soil, that are accessible to the public, need to be fenced in. The building on the Alling Lander property, which currently is easily accessible and vandalized, needs to be boarded up and secured.

4) CT DEP (Air Division) needs to continue to monitor the odors from Dalton Enterprises and make sure that they do not violate any regulations. Dalton Enterprises has had numerous complaints from nearby residents, but has never been cited.

5) CT DPH recommends that further evaluation of the Alling Lander and County Wide Construction sites be undertaken to help determine if remediation is necessary.

H. Public Health Action Plan

Actions Taken

1) CT DPH has assisted the community in forming the Cheshire Community Advisory Panel (CAP). The panel is made up of town leaders and concerned citizens who assist and advise CT DPH on the concerns of the residents and serve as liaison between the public and CT DPH.

2) CT DPH has met routinely with the CAP, CT DEP, RWA, and Chesprocott Health District to discuss the details of the Cheshire PHA. The meetings have included discussions of important environmental issues in the town and efforts to resolve many of these issues. CT DPH has also educated community leaders on environmental issues in Cheshire and methods to resolve many of these issues.

3) CT DPH held a Public Availability Session (PAS) in Cheshire to educate the residents about the Cheshire PHA process and distribute information relating to local environmental issues.

4) CT DPH held another PAS in May 2004 when the draft of this PHA was released to allow the public an opportunity to ask questions concerning the details of the PHA as well as comment on the PHA. In addition, CT DPH will hand out information and educate the residents about environmental issues in the town of Cheshire.

5) CT DPH prepared a fact sheet in May 2004 to summarize the results and conclusions of this PHA. The fact sheet was distributed at the PAS in May 2004.

Actions Planned

1) CT DPH will continue to work closely with the Cheshire CAP, CT DEP, RWA, town leaders, and the Chesprocott Health District to ensure that the environmental concerns of the residents of Cheshire are met.

2) CT DPH will analyze childhood cancer rates in Cheshire for the years 2001–2006, when the rates become available. CT DPH will prepare a health consultation that will include the findings of the analysis.

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Certification

The Public Health Assessment for Evaluating Community Concerns in Cheshire, Connecticut was prepared by the Connecticut Department of Public 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 initiated.

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The Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this Health Consultation and concurs with its findings.

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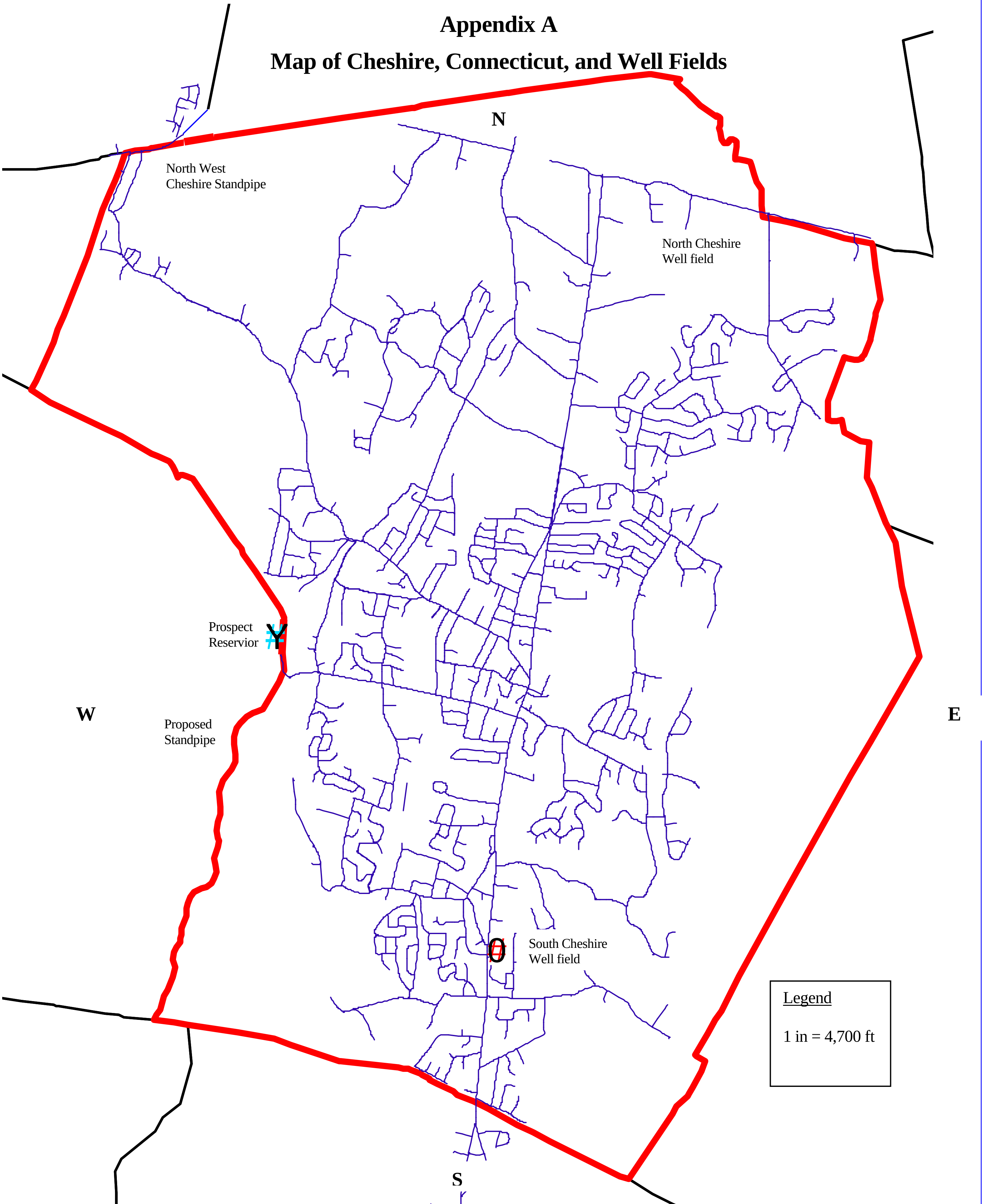
Appendix A

Map of Cheshire, Connecticut, and Well Fields



Appendix B

South Central Connecticut Regional Water Authority Cheshire Water Supply History of Events

Date	Event
1908–1958	RWA constructs a series of distribution mains in the town of Cheshire. 100% of water to Cheshire customers comes from Prospect Reservoir on Prospect/Cheshire Line.
1959	North well field is in development. North well #1 is place on-line. Water to Cheshire customers is now primarily from the reservoir, mixed with water from north well # 1. This mix is maintained through 1974.
1974	North well # 4 is placed on-line.
1977	South well field is in development. South well #1 is placed on-line.
1978	Prospect Reservoir taken off-line due to costs related to compliance with federal safe drinking water act requirements. Cheshire customers are now receiving water from north wells #1 and #4, and south well #1. Additional wells will be added in future years.
1979	South well # 2 is placed on-line. The distribution system now consists of North wells #1 and #4, and south wells #1 and #2.
Aug. 1979	Elevated TCE levels found in north wells #1 and #4. North well #4 is taken off-line through part of November 1979.
Nov. 1979 – June 1980	North well # 4 used as barrier well. November 1979 TCE levels for north well #1 = 20, 22, 200, 26, and 11 ppb.
June 1980	North well #4 put back on production line. North well # 5 becomes barrier well for next 9 years.
Dec. 1980	North well # 4 TCE levels = Not detected, 1.0, 2.2, 1.6, and 249 ppb.
1981	TCE found in south wells #1 and #2 in November 1981.
1982	South wells #1 and #2 taken off-line February–December due to TCE presence.
1983	South wells #1 and #2 remain off-line January–May and December due to TCE presence. South well field is used during peak demand periods of summer months—July through Sept. 30th—under certain conditions, with special permission granted by CT DPH. South well field used in November on part-time basis, as needed, while north well field undergoes a Phase II TCE contamination study. ——— DCP is discovered in north well #1.
Aug. 1984	DCP is discovered in south well field.
1985	Aeration treatment facility is completed in June for the south well field.
1987	Aeration treatment facility is completed in for the north well field.
1989	North well #5 removed from barrier status and is placed on-line.
1993	North well #6 is placed on-line.

Appendix C

Cheshire Sites of Concern

Airpax Corporation (Plant I)

Airpax Corporation (Plant I), located at 150 Knotter Drive in Cheshire, Connecticut, manufactured electro-mechanical and electronic devices, primarily timing devices and motors, from 1972 to the present. The processes uses include tumbling, molding, etching, welding, dipping, painting, and cleaning of parts. Substances used in these processes include acids, alkalines, organic solvents, derusters, and oil. The company also uses brass (copper and tin), aluminum, copper, steel (iron and lead), and stainless steel (chromium) in various processes.

From 1976–1984, primary manufacturing operations and the wastewater treatment facility for the Airpax Corporation were located at this site. Treated process wastewater was discharged into two 75-foot leaching trenches from 1973–1983. The company also discharged noncontact cooling water to Judd Brook. Currently, only assembly operations are conducted at Plant 1. Primary manufacturing and wastewater treatment operations were moved to Airpax Corporation Plant 2 nearby. Because of past disposal of hazardous substances into a leachfield, CT DEP recommended a site inspection in May 1984 to evaluate the potential effects of this activity on the environment. Soil sampling in the leachfield in 1984 by CT DEP detected metals, such as zinc, barium, copper, nickel, chromium, and barium. The detected levels were below the CT Remediation Standard Regulations (CT RSRs) for industrial soils. One volatile organic compound (VOC), benzene, was detected in soil in the leachfield, but only at trace levels. Surface water and sediment samples taken along an unnamed brook south of the site and from Judd Brook indicated the presence of heavy metals, such as barium, copper, zinc, lead, iron, and manganese, at levels below CT RSRs. Trichloroethylene (TCE) was detected in the sediment sample along the unnamed brook at trace levels. Benzene was also detected at trace levels in the soil along the east side of a building. The site is located about 2.1 miles southeast of the north Cheshire well field and is not within the aquifer used by the public water supply. Therefore, the public water supply is not affected by the site.

After a 600-gallon antifreeze spill in 1991, a CT DEP contractor installed four groundwater monitoring wells. The spill occurred in the building on the west side of the property, in the equipment chiller unit for the engineering test laboratory. One well contained 1,800 ppm of propylene glycol, but after quarterly sampling for a year, the concentrations decreased to below detection limits. In 1994, EPA contractors investigating a plugged storm drain detected grease and oil hydrocarbons, methylene chloride, and 1,1,1-trichloroethane in a shallow water table on the Airpax property. Contaminated soil and sludge were removed from the storm drain. Fifteen groundwater samples were taken in July 1994 around the wastewater leachfield on the southeast side of the building and the south building foundation by an EPA contractor. The samples indicated VOC contamination in the groundwater onsite. The highest contamination was found at the process wastewater leachfield and along the southeast foundation on the south side of the building. The contractor determined the source of the groundwater contamination to be the former process wastewater leachfield. These groundwater samples indicated that several detected VOCs (1,1-dichloethylene, 1,1-dichloroethane, 1,1,1-trichloroethane, trichloroethylene, tetrachloroethylene) exceeded state and federal drinking water standards. Four private residential wells were tested within ½ mile of the site because of concern that the VOCs may have migrated into residential wells. Only very low levels were found (1.0 or 1.1 ppb of 1,1,1-trichloroethane) and all VOC concentrations were below federal and state drinking water standards. The source of the low level VOC groundwater contamination in the private wells was unknown. A different groundwater sampling in 1994 directly beneath the Airpax building indicated the presence of heavy metals (lead, thallium, chromium, beryllium, and nickel) that exceeded state and federal drinking water standards, but no VOCs were detected in this set of samples. Surface water samples were taken in March 1994 from the shallow pools at the groundwater to surface water interface. Those samples contained several VOCs (1,1-dichlorethylene, 1,1-dichloroethane, 1,1,1-trichloroethane, trichloroethylene, and methylene chloride) that exceeded current drinking water standards. Surface water sampling from the south tributary to Judd Brook and upstream from the location at which water from the roof drain discharge would enter the tributary did not indicate any contaminants. Further onsite sampling in the same locations as the surface water sampling in June 1994 indicated VOC (2-butanone, acetone, and toluene), pesticide (4,4'-DDE, 4,4'-DDD, and 4,4'-DDT), and heavy metal (lead, chromium, barium, arsenic, and copper) contamination, but these levels were all well below CT RSRs for industrial soil criteria.

In conclusion, contamination was present in onsite soil, sediment, surface water, and groundwater in 1984, 1991, and 1994. However, the health of the general population was not affected by this contamination. The offsite surface water and sediment did not exceed federal and state standards and groundwater contamination did not migrate in significant quantities offsite to private wells, as indicated in 1991 sampling. Furthermore, the site is located off the aquifer used by the north Cheshire well field.

Alling Lander Company

Alling Lander Company is located at 300 East Johnson Avenue in Cheshire. The company manufactured gears for conveyor belts and for doors from 1980 to 1988. For the 20 years before 1980, other gear companies operated on the property and used the same products as Alling Lander. Alling Lander is situated in an I-2 commercial zone, which is also in a public water supply aquifer called the Aquifer Protection Overlay Zone.

According to a memo by the Connecticut Department of Environmental Protection Hazardous Waste Unit, Alling Lander Company admitted to spilling the entire contents of a drum containing TCE or 1,1,1-trichloroethane (TCA) within the building as early as 1979. The contents may have emptied into a former floor drain, which was believed to drain directly into the ground beneath the building. After finding TCE in wells directly to the east of the facility, and with the knowledge that TCE and other solvents had been used in the metals operations onsite since at least 1970, CT DEP issued a pollution abatement order to Alling Lander in 1983. Onsite surface soil sampling in 1984 indicated the presence of VOCs, including TCE (1,300 ppb), TCA (53,000 ppb), and vinyl chloride (118 ppb), at levels that do not exceed CT RSRs for industrial soils. Onsite groundwater analyses indicated the presence of TCE (50 ppb) and TCA (77 ppb). Only TCE exceeded current federal and state drinking water standards.

Cooling water of unknown origin was reported to be discharged directly onto the north lawn of the Alling Lander site before December 1983, when an active septic system began receiving cooling water via floor drains. Information concerning the location of the septic system and the leachfield was not available.

CT DEP required Alling Lander to take responsibility for the VOC contamination in December 1983. Alling Lander appealed the order, claiming the source of the groundwater pollution was County Wide Construction, a nearby company whose hydrogeologic consultants also recommended soil removal. Because Alling Lander is located 0.9 mile north of the north Cheshire well field, CT DEP had some concern that the groundwater contamination leached into the public water supply. Despite this dispute, Alling Lander was ordered in January 1984, to supply a potable water supply to three or four properties within a 0.2-mile distance from the property whose private water wells were contaminated with VOCs[2]. The groundwater VOC concentrations were up to 1,500 ppb at County Wide Construction (342 E. Johnson Ave) and up to 141 ppb at the residences. Alling Lander complied with this order by paying for the houses within the 0.2 mile distance to be connected to the public water supply by 1990. A groundwater sample containing 15 ppb of TCE was reported in one of the neighboring private wells near the site. There are also 10 additional properties within 0.50-mile from the facility that have private wells. (Refer to Appendix C, Cheshire CERCLIS Sites, County Wide Construction for a more detailed description of the private well data in this neighborhood.)

In April and May 1986, two more groundwater monitoring wells were installed by an Alling Lander contractor. Samples did not exceed concentrations above 1 ppb of VOCs, but a letter written by the Southern Connecticut Regional Water Authority (RWA) indicated levels of TCE up to 37 ppb in the onsite wells. Further sampling by the RWA taken in June 1986 indicated levels of TCE up to 36 ppb in one of the groundwater monitoring wells.

In May 1987, CT DEP issued an order requiring Alling Lander to remove contaminated soils and provide the County Wide property and nearby residences with potable water. In 1987, the company removed approximately 2,750 cubic feet of contaminated soil from an area near the metal-sided shed, where drums and a "metal-shavings" trash receptacle were formerly located. The soil was reportedly contaminated with 1,1,1-TCA, TCE, and PCE. In addition, the catch basin located northwest of the building, near the location of the drums storage area observed during the January 1984 CT DEP inspection, was removed.

In 1988, Alling Lander ended operations at 300 East Johnson Avenue. In April and May of 1992, an EPA contractor installed three onsite groundwater monitoring wells, dug three test pits and 11 test borings, and conducted an 82-point soil gas survey underneath the building and to the southeast of the building. In September and October of 2001, an EPA contractor performed soil and groundwater sampling on the site, but the results of the sampling were not available.

Sometime around 1991, Alling Lander Company filed for bankruptcy and the mortgage lender took over the property. The property was leased to Summit Construction Services (SCS) from 1991–1993. From 1993 to the present, the property was and continues to be abandoned and unoccupied.

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[2] There is some discrepancy in the CT DEP files about the date at which the residences were actually provided potable water. Another order, issued in May 1987, states that Alling Lander was required to provide potable water to these residences and revoked the previous orders.

In 2001, an EPA contractor tested soil and groundwater from the site. TCE levels up to 170 ppb in samples from two of six of the monitoring wells exceeded state and federal drinking water standards. In the soil samples, only a pesticide, Aroclor 1254 (maximum levels of 8,700 ppb), and semivolatile organic compounds (SVOCs; benzo(a)pyrene up to 1,700 ppm, benzo(b)fluoranthene up to 2,200 ppb, and benzo(a) anthracene up to 1,700 ppb) were found in six of 16 soil samples to have concentrations above CT RSRs. VOCs were not found in these soil samples at levels above the CT RSRs.

In conclusion, groundwater and soil contamination was present in the past on the Alling Lander property and the VOC contamination may have leached into nearby residential and industrial wells. CT DEP identified Alling Lander as the source of the groundwater VOC contamination that has directly affected the private and commercial well water of the nearby neighborhood. In 1983, CT DEP ordered the company to supply the neighboring homes with potable water until those residences were hooked up to the public water supply in 1990. Onsite, soil was contaminated with VOCs at least until 1985. Though some soil has been removed in the past, some soil contamination still remains, as seen in the results of the 2001 sampling. Groundwater beneath the site was contaminated, at least until 2001, when the last round of groundwater sampling was performed. Safety is also a concern. A CT DPH site visit in 2003 found that there are no fences surrounding the property, so the site is relatively easy to access. In addition, CT DPH personnel observed broken glass inside the building from the windows, indicating that vandals have already been to the area.

Ball and Socket Lagoon

Ball and Socket Lagoon, which was purchased by Dalton Enterprises in 1996, is located on Willow Street in Cheshire. This site was used for disposal of untreated industrial wastes from Ball and Socket Manufacturing Company from 1958–1970. Typical discharges included copper, zinc, iron, nickel, cyanide, and unknown VOCs. In 1984, the CT DEP, Water Compliance Unit asked Ball and Socket to remove contaminated soils from the site. The excavation was completed in November 1984 and the soils were placed in the Cheshire municipal landfill. Ball and Socket also implemented a groundwater recovery program (pump and treat) system to control offsite migration of groundwater contaminants. Ball and Socket contracted a consulting company to do soil sampling and groundwater monitoring in 1983, which indicated levels of VOCs above current drinking water standards and in soil above Connecticut Remedial Standard Regulations (CT RSRs). Ball and Socket continued to monitor groundwater onsite until it was purchased by Dalton Enterprises in 1996. Dalton Enterprises continues to monitor the groundwater from this site. Water sampling indicates that levels of VOCs in groundwater have continued to decline over time. In addition, in 1994, the EPA determined that a “no further action at this time” decision be made for the site. That means the site was not judged to be a potential National Priority List (NPL) or Superfund site. Off-site, nearby private residential well testing in 1994 of physical/chemical and metal parameters indicated that all analytical results did not exceed current drinking water standards. After 1994, residents in the nearby community were not exposed to the contaminated drinking water, but it is unknown whether the off-site residential private wells nearby were contaminated with VOCs from this site before that date. This site has no effect on the public water supply because it is in a different watershed from Cheshire’s public water supply well fields.

Bovano Industries

Bovano Industries occupies a 2.7-acre site at 830 S. Main Street in Cheshire. The company has manufactured gifts and ornamental glass objects, such as ornamental jewelry and figurines, at the site since 1955 and currently continues to operate. Manufacturing operations have included pickling (removal of scale, oxides, and other metal surfaces by immersion in an inorganic acid), solvent cleaning, glass enameling, and metal baking. Wastes included metal finishing scraps containing sulfuric and nitric acids, waste solvents, including trichloroethylene (TCE), spent ferric chloride etchant (acid or corrosive used for etching) and metal hydroxide sludge. Bovano Industries was considered by the CT DEP as a potential contributor of TCE contamination of the south Cheshire well field due to the operation of a copper sludge lagoon and drywell and the use of TCE. The south Cheshire well fields are located 1 mile south of the site and groundwater flow is in a southeasterly direction.

In 1982, CT DEP issued an order to abate pollution, which required the facility to determine the extent, if any, of soil, surface water and groundwater contamination. The facility discontinued the use of TCE at this time. In addition, Bovano Industries was required to implement a waste handling system that would end the practice of discharging metal finishing wastes to groundwater via a sludge lagoon. In this 1982 study, TCE was detected at a maximum level of 1,220 ppb and copper at 10,200 ppb in the groundwater monitoring wells onsite. The concentrations are well above state and federal drinking water standards. The facility excavated and removed the sludge lagoon, material from the drywell and soil from the chemical storage area in 1985 and 1986. Further onsite groundwater and soil sampling in 1989 from the site indicated that VOCs were no longer detected in any of the samples. Residents of Cheshire using the public water supply could have been exposed to TCE from this site because it was a potential contributor of TCE contamination of the south Cheshire well field before 1982. Currently, Bovano Industries poses no risk to the general Cheshire population.

Carbide Mold

Carbide Mold (CMS Graphite), located at 340 Industrial Avenue, is a facility that cuts and lathes blocks of graphite into molds for certain industries. The site obtains its water from a well which is shared by the adjacent building which is occupied by Oslo Controls. According to a groundwater study by the Chesprocott Health District in 1985, onsite groundwater samples were contaminated with low levels of VOCs, including methylene chloride, trichloroethylene, tetrachloroethylene, 1,1,1-trichloroethane, and 1,1-dichlorethane at concentrations up to 10 ppb (methylene chloride) which is above federal drinking water standards. According to the study, the alleged source of contamination for the area was the former U.S. Chemical Corporation, which is adjacent to Carbide Mold (and southeast). In 1990, onsite soil samples taken by the CT Department of Environmental Protection (CT DEP) indicated that there was low level VOC contamination (methylene chloride and 1,1,1-trichlorethane) at concentrations up to 14 ppb which is well below Connecticut Remediation Standard Regulations for industrial soils. Soil is not a likely source of exposure except to a small population of workers and trespassers on the site. In 1990, onsite groundwater sampling by the CT DEP indicated that VOC contaminant levels have decreased to levels far below drinking water levels and barely above detection limits. More recent onsite groundwater sampling indicated that VOC contaminant levels have remained very low. There is no information available that suggests that any remediation of any kind was performed. The general population in Cheshire would not have been exposed to groundwater contaminants through the public water supply because the Carbide Mold site is not on the same aquifer used to supply public drinking water.

Cheshire Municipal Landfill

The Cheshire Municipal Landfill (property) is located on Route 70 (Waterbury Road) in Cheshire, Connecticut. The property currently operates as a municipal waste and recycling transfer station, and houses the town public works maintenance facilities. The entire property is 97.59 acres.

The property is owned by the Town of Cheshire. It operated as a landfill from the 1930s until 1989. Two separate landfill areas are located on the property. The first landfill is approximately 18.44 acres in area and is permanently closed and capped. This capped landfill received industrial wastes from 1970 until its closure in 1989. This landfill area will be referred to as the “closed landfill.” A second waste disposal area, approximately 12 acres in size, is located just south of the capped landfill. This smaller landfill was used from the 1930s until it was filled to capacity and covered with soil in 1970. However, the disposal of metal hydroxide sludge in a CT DEP-approved area of this smaller landfill continued until 1987. This smaller landfill is currently not permanently capped. This landfill will be referred to as the "former solid waste disposal area".

According to a survey performed by the Chesprocott Health District in 2000, approximately 69 private wells are located within ½-mile down-gradient of the landfill property. The nearest public water supply well is approximately 1 mile north and is not within the same aquifer as the landfill property.

Closed Landfill

This 18.44-acre landfill area was capped and closed in 1989. A town contractor has been conducting quarterly groundwater sampling for VOCs and leachate indicators from 10 monitoring wells onsite. The onsite monitoring wells are used to measure the quality of the groundwater at the landfill and are not used for drinking water.

In addition, five private drinking water wells located downgradient of the closed landfill are sampled semi-annually. Finally, the effect of landfill leachate on adjacent surface water is monitored upstream of the landfill on the Ten Mile River, downstream of the landfill on the Ten Mile River and at the outfall of a small pond east of the landfill.

Elevated leachate indicator parameters in groundwater from onsite groundwater monitoring wells indicate that the landfill is contaminating groundwater. Significant VOCs detected in groundwater are trichloroethylene (found at concentrations as high as 21 ppb), tetrachloroethylene (found at concentrations as high as 90 ppb), benzene (found at concentrations as high as 4.5 ppb), and vinyl chloride (found at concentrations as high as 24 ppb). All of these concentrations exceed federal and state drinking water standards. No one is drinking the groundwater from the onsite monitoring wells.

Surface water sampling results indicate that the landfill is moderately affecting surface water, as measured by the presence of landfill leachate indicator parameters.

Private wells near the landfill have been sampled on several occasions. In 1999, the Chesprocott Health District conducted a water quality survey of 57 private wells nearest the landfill property. Results showed no landfill effects on private well water quality, with the possible exception of two wells at the end of Moss Lane. Those two wells showed very low levels of VOCs. It is unknown whether the trace VOCs in the two wells came from the landfill or another source. In response to the Chesprocott Health District survey, the public water line was extended along Moss Lane. In September 2000, three new houses on rear lots close to one of the onsite landfill groundwater monitoring wells were connected to public water, as was at least one other residence on Moss Lane. The Chesprocott Health District concluded that it would be prudent for residences along Moss Lane to connect to the public water supply.

As mentioned above, five residential wells located downgradient of the closed landfill are monitored twice a year. These wells are located on Moss Lane and Moss Farms Road and include the wells that were found in 1999 to have trace levels of VOCs. In October and November 2002, tetrachloroethylene (PCE, perc) was detected at the reporting limit of 0.5 ppb in one well on Moss Lane. The drinking water standard for PCE is 5 ppb. VOCs in the other four wells were below detection limits. Monthly follow-up sampling was conducted from November 2002 until March 2003 at the well found to have detectable PCE levels in the fall 2002. The PCE detections were not reproduced in the monthly follow-up sampling. CT DPH does not have results of residential drinking water well sampling after March 2003.

Former Solid Waste Disposal Area

The waste disposal area is bordered to the north by the closed landfill. A steep slope exists along the eastern perimeter where the landfill is bordered by an unnamed stream and associated wetland. There are a number of residential properties located east, south, and west of the site. A former Veterans of Foreign Wars building is located northwest and an industrial forging company is located immediately west, across Route 70. Groundwater flow appears to be northeast, toward the unnamed stream, which discharges into Ten Mile River.

Several investigations of the former solid waste disposal area have been performed. Test pit investigations from 2003 show that the former disposal area contains a variety of wastes and debris, including residential trash, metal drums, scrap metal, demolition debris, burned waste and ash, glass, appliances, car parts, industrial waste oil, and hydroxide sludge. Some removal of scrap metal and buried drums was performed in 2001 (Metcalf and Eddy, 2004). A small amount of stained soils was excavated at the same time. Soil sampling from the sides and bottom of the soil excavation showed levels of total petroleum hydrocarbons exceeding state clean-up standards (up to 4,700 mg/kg). Limited soil sampling in the area of the metal hydroxide sludge lagoon indicated low levels of lead and chromium and some VOCs and SVOCs.

Soil gas sampling and ambient air measurements from inside two buildings onsite was done in 2003 to evaluate concentrations of methane and hydrogen sulfide (Metcalf and Eddy, 2004). No detectable levels were identified inside buildings. At two locations in the former disposal area, methane was measured in soil gas at levels above the lower explosive limit of 5%.

A groundwater assessment has been conducted to evaluate the effects of the former solid waste disposal area on groundwater (Metcalf and Eddy, 2004). A groundwater monitoring well network exists around the perimeter of the disposal area. Levels of benzene, trichloroethylene, and tetrachloroethylene in groundwater samples from monitoring wells onsite exceed drinking water standards. The onsite monitoring wells are used to measure the quality of the groundwater at the landfill and are not used for drinking water.

Surface water from the unnamed stream located east of the former solid waste disposal area was sampled in 2003. Results were compared with CT Water Quality Standards Aquatic Life Criteria and no exceedances were found.

The former solid waste disposal area has not been capped to comply with CT DEP requirements. The Town of Cheshire submitted a landfill closure plan to CT DEP in March 2004. CT DEP has reviewed the plan and submitted a request for clarification on several points to the Town of Cheshire. The town is considering CT DEP's request. As part of the investigations supporting preparation of the landfill closure plan, the contractor working for the Town of Cheshire identified five additional private wells located east (cross gradient) and across the unnamed stream from the former solid waste disposal area that have not been monitored routinely. The landfill closure plan submitted to CT DEP on behalf of the Town of Cheshire contains a recommended monitoring plan for landfill closure, which includes sampling the five additional private wells. These wells are cross-gradient to the former waste disposal area rather than directly downgradient. It is not very likely that they have been affected by the landfill, so the recommendation to sample them is for precautionary purposes only.

Summary

Environmental investigations of the closed landfill and the former solid waste disposal area indicate that the landfills are affecting onsite and off-site groundwater, nearby surface water, and onsite soils at the former solid waste disposal area.

Onsite groundwater sampling indicates that drinking water standards for a number of VOCs are exceeded. However, onsite groundwater is not used as drinking water, so there are no exposures to the contamination in the onsite groundwater. Limited soil sampling at the former solid waste disposal area indicates the presence of low levels of lead, chromium, some VOCs, and some SVOCs in the area of the metal hydroxide sludge lagoon. Soil gas sampling shows the presence of methane at two locations. Methane was not detected in onsite buildings. Surface water sampling results from locations downstream of the closed landfill indicate that the landfill is moderately affecting surface water.

With regard to exposure potential, the former solid waste disposal area is not permanently capped and is not fenced. Trespassers could be exposed through soil contact, but given the low levels of contaminants, it is very unlikely that such exposure would pose a health risk. Offsite groundwater used for drinking water by residents of Moss Lane and Moss Farms Road presents the only other potential for exposure. Private well water sampling results reviewed by CT DPH detected very low levels (below drinking water standards) of some VOCs in two private wells. Private wells at greatest risk for contamination from the landfill are monitored regularly, so it is unlikely that significant exposures would occur without detection. Therefore, it is unlikely that exposures would occur at levels that would pose a health risk. Regarding past exposures, private well data is not available to assess whether significant exposures may have occurred in the past. As stated above, Cheshire residents using public drinking water would not be exposed to groundwater contaminants from the landfill because the landfill is not within the same aquifer as the public drinking water supply.

County Wide Construction

County Wide Construction is located at 344 East Johnson Avenue in Cheshire. This property was formally known as Jubilee Builders Company and has served as a base of operations for those construction companies. County Wide Construction is situated in an I-2 commercial zone, which is also in a public water supply aquifer called the Aquifer Protection Overlay Zone. The site is bordered to the east by a private residence, to the south (across East Johnson Avenue) by a produce farm called Delucia Farms, to the west by Cheshire Manufacturing, and further west by Alling Lander Company. Activities known to have taken place on this site are typical construction services such as excavation, trucking, and siding and window installation. Other activities involve active maintenance of heavy equipment, solar panel research and development, printing and storage of solar panel equipment, and maintenance of general construction equipment.

CT DEP reported numerous problems around or before 1984 regarding spillage of contaminants from heavy equipment and bulk storage containers. The potentially hazardous materials used onsite consist primarily of nonchlorinated organics (petroleum product constituents). At the time, CT DEP had been concerned with “bay area spillage of contaminants into the ground, inadequate inventory of chemicals used at the site, excavation of previously buried wastes, and possible violation of handling and storage of waste oils.”

In November 1983, three sludge samples from the drains in the bay area onsite and one soil sample from a waste storage area were collected by CT DEP personnel. The samples were analyzed for VOCs by the state of Connecticut Public Health Analytical Laboratory. The results indicated the presence of benzene (50 ppm), toluene (420 ppm), mixed xylene (240 ppm), methanol (300 ppm), and 1,1,1-trichloroethane (TCA) (970 ppb), although it is not listed in the CT DEP files which results are soil samples and which are sludge samples. Concentrations of benzene, mixed xylene, toluene, and TCA were all below Connecticut’s Remediation Standard Regulations (RSRs). Although, there is no CT RSR concentration for methanol, the contaminant is below ATSDR’s health based child soil comparison value (Reference Dose Evaluation Media Guide or RMEG) of 30,000 ppm. Soil concentrations below this level are unlikely to pose a health threat.

During periodic inspections of the County Wide property around 1987, RWA observed several oil and petroleum spills, the improper use of refuse, including a leaking 275-gallon fuel oil tank, used oil filters, a discarded engine block, and partially buried truck tires.

These routine RWA inspections and the results of the soil and floor drain sediment samples taken from the County Wide property prompted CT DEP to take action. It issued an order in December 1983 to Jubilee Builders Company and to County Wide in May 1984 (reflecting a name change) requiring the company to implement a best management practices plan for chemical storage handling and disposal. Jubilee Builders/County Wide also had to eliminate all discharges from garage floor drains to the ground.

In 1983, several groundwater samples collected by CT DEP from County Wide and from private residential and industrial wells in the area were found to contain volatile organic compounds (VOCs). Shallow groundwater samples on the County Wide property indicated levels of TCA at 1.5 ppm and TCE at 14 ppb. Eight other wells in the immediate area were tested. The maximum concentrations were as high as 141 ppb for TCE and 12 ppb for TCA. One of the contaminants, TCE, exceeds state and federal current drinking water standards. As a result of the contamination, the RWA conducted a hydrogeological study on ground contamination and concluded that the source of the contamination of the north Cheshire well field is most likely located north of the well field. CT DEP did a series of sampling and analysis and determined that Alling Lander was the source of the contamination in the immediate area of E. Johnson Avenue. Further sampling by the RWA in April 1984 and March 1985 on the County Wide property indicated levels that reached a maximum concentration of 1500 ppb for TCE (October 1983) and remained at elevated levels for TCE at 776 ppb in February 1986. By March 1985, sampling of the nearby sites indicated VOC levels had decreased to either non-detectable levels or at or below 1 ppb for TCE, PCE, and/or TCA. The exceptions are 340 E. Johnson Avenue where TCE levels were at 25 ppb in February 1986 and 368 E. Johnson Avenue where TCE levels were 103 ppb in March 1985 and 52 ppb in February 1986. Both of these addresses are private residences. In response to the elevated groundwater VOC levels in the area, CT DEP issued an order to Alling Lander, who was at least partially implicated as a source of groundwater contamination in the area, requiring provisions of potable water to neighborhood residences. In 1990, private residences in the area were connected to the public water supply.

In July 1985, 42.5 tons of soil were removed from the drywell location at County Wide to comply with orders issued in 1983 and 1984 by CT DEP. Bottom composite soil samples analyzed by a contractor indicated ethylbenzene (70 ppb), xylenes (810 ppb), TCE (225 ppb), and methylene chloride (504 ppb). Side composite samples of the excavated area did not detect the presence of any organic compounds.

Sometime in 1991, the owner of County Wide abandoned the property and the mortgage lenders appointed a trust company to manage the site. In October 1991, an environmental firm contracted by EPA performed a Phase I Site Assessment Report and a Limited Phase II Environmental Site Assessment Report in May 1993. The contractor collected five soil samples in April 1993 near of a 2,000 gallon underground diesel storage tank and an abandoned waste oil tank and one groundwater sample from an onsite monitoring well. Soil samples indicated concentrations of total petroleum hydrocarbons (TPH), ranging from 23.7 ppm and 42.3 ppm. Low-level concentrations of VOCs were detected in the groundwater sample, but were not available.

In conclusion, groundwater and soil contamination was present in the past on the County Wide Property and the VOC contamination may have leached into the nearby residential and industrial wells in the area. Private residences may have been affected by the site through VOC groundwater contamination until 1987 when they were connected to the public water supply. Onsite, the soil was contaminated with VOCs and TPHs at least until 1993. After 1993, because soil sampling did not occur after the date, it is unknown whether the soil was and is still contaminated. Groundwater beneath the site was contaminated at least until 1993, but it is unknown whether the groundwater was or is still contaminated because sampling did not take place after that date. As of 2002, EPA was planning to conduct a site reassessment on this site. This report has not been completed yet, but may include additional sampling.

Dalton Enterprises/Ball and Socket Manufacturing

The Ball and Socket Manufacturing Company, Inc., located at 493 West Main St, Cheshire, CT used to manufacture buttons from the turn of the twentieth century through 1994, when operations ceased. Operations at the plant included stamping, plating, tumbling, degreasing, surface coating, and shipping. Hazardous substances handled at the plant included those found in nickel, brass, and gold plating, cyanide solutions, chlorinated solvents, corrosives, lacquers, and waste oil. These were contained in drums, tanks, wastewater treatment systems, a recovery unit (for gold), and a still (for chlorinated solvents). Additionally, there was no. 6 fuel oil in an above-ground storage tank, and metal hydroxide sludges in wastewater treatment systems, and lagoons. There is no evidence of onsite groundwater or soil contamination onsite.

Dalton Enterprises acquired Ball and Socket Manufacturing Company in December 1996 and used it to open a plant that manufactured driveway sealants. There have been complaints by the nearby residents concerning “petroleum-like” odors. The Connecticut Department of Environmental Protection (CT DEP), Air Bureau responded by implementing a series of random inspections of the facility. Though the CT DEP has never detected an odor at the plant that was determined to be a nuisance and therefore a violation of state regulations, Dalton Enterprises has taken steps to minimize odors such as asking venders to turn off their trucks when making deliveries instead of letting them idle. Outdoor air sampling is typically not performed unless there is a visible plume in the air. However, because of the diffusion properties of air, it is unlikely that the activities of the site actually contaminated the outdoor air. Because we found no evidence of contamination in the air, water, or soil onsite, we concluded that the activities of Dalton Enterprises/Ball and Socket Manufacturing have not affected the health of Cheshire residents.

Holgrath Corporation

The Holgrath Corporation, is located on 30 Knotter Drive in Cheshire Industrial Park. It is adjacent to the Cheshire Associates Property, which is a former Superfund Site. Holgrath manufactures stainless steel hypodermic and spinal needles. In this manufacturing process, small diameter stainless steel tubing is cut, ground, cleaned, and polished. Acidic washing compounds, degreasing solvents, and detergents are used in this process. Wastewater from these manufacturing processes is collected into a settling tank where it undergoes pH adjustment with caustic soda. As of 1986, the wastewater was being released into the Cheshire sewer system at a rate of approximately 6,500 gallons a day under a National Pollution Discharge Elimination System permit. Prior to October 1981, discharge from the settling tank was released to a leach field located on the Holgrath property. In 1980 and 1982, contents of the settling tank sampled by the Connecticut Department of Health, Laboratory Division indicated the presence of several metals and VOCs including hexavalent chromium, nickel, zinc, aluminum, toluene, tetrachloroethylene, 1,1,1-trichloroethane, and chloroform with a maximum concentration of 30 ppm for VOCs and 85 ppm for metals. Several of these contaminants are above state and federal drinking water standards. Because the contaminated wastewater was released into a leachfield prior to 1981, there is a potential for soil and groundwater contamination. Since soil exposure is limited onsite, people would only be exposed to the soil contamination if they were previous workers or trespassers, so this pathway may be very limited. Local groundwater may have been impacted by Holgrath Corp in the early 1980s, but it is unknown because groundwater sampling was not performed. This site would have no impact on the public water supply because it is not within the same aquifer as the public water supply.

Olin Corporation

Olin Corporation, located at 350 Knotter Drive, is a chemical research and developmental facility that has been in service since September 1984. Processes include bench-scale analytical and developmental work with pool chemicals, urethane foams, automotive fluids, biocides, surfactants, and detergents. Olin generates the following types of chemical wastes as a result of laboratory analyses: acetone and other assorted solvents, polyols, glycol ethers, methylene chloride, hydrofluoric acid, sulfuric acid and other miscellaneous acids, corrosive aqueous solutions from HTH (pool chemical), and other miscellaneous pool chemicals. Olin Corporation is served by a public water supply since 1984. Its laboratory sinks and sanitary waste discharge to a public sewerage system as of 1981. Prior to 1981, wastes were discharged to a privately owned sewerage system. There was a 1,500-gallon underground storage tank (UST) of unknown use on the property in which Olin emptied, cleaned, and closed which contained ignitable organics and were disposed of as hazardous waste.

There was an EPA and CT DEP inspection in the late 1980s that resulted in an administrative order to remediate the property. The details of the order were not available. Olin appealed the order and it was later dropped. Arch Chemicals was created in February 1999, as a separate entity comprised of the former pools division of Olin Chemicals. Groundwater monitoring by a CT DEP contractor in 1999 indicated VOC contamination in only one monitoring well where various VOCs exceeded state and federal drinking water standards (toluene at 2 ppm, 1,1-dichlorethane at 320 ppb, chloroform at 400 ppb, and xylenes at 880 ppb). Other VOCs (1,3,5-trimethylbenzene, 1,2,4-trimethylbenzene, and isopropylbenzene) were also detected in the groundwater during the 1999 sampling, but have no federal or state drinking water standards. Groundwater contamination in this monitoring well was thought to be from three spills of fuel oil by a UST in 1991, 1992, and 1993, although some of the chemicals found in the wells are not typically found in fuel oil. In this same study, soil samples did not indicate the presence of any contaminants exceeding state or federal standards.

Quarterly groundwater sampling in 2001 and up to February 2002 by an Arch Chemicals contractor indicated that all VOC have decreased to levels below the detection limit except for toluene which had one sample reading of 4.2 ppb, which is below federal and state drinking water standards. Private wells were not impacted by this possible contamination since there are no known private residential wells in the nearby area. However, because the groundwater contamination beneath Olin/Arch has decreased to almost nondetectable limits, the exposure was no longer present after 2001. This site has no effect on the public water supply because it is not on the same aquifer.

Oslo Controls

Oslo Controls, located at 328 Industrial Avenue, has manufactured push-button switches and indicator lights at this site since 1978. In 1979, VOCs were discovered in the site groundwater wells in amounts that were below federal and state action levels. According to a groundwater study by the Chesprocott Health District in 1985, onsite groundwater was contaminated with low levels of VOCs, including methylene chloride, 1,1,1-trichloroethane, 1,1-dichloroethane, toluene, trichloroethylene, and tetrachloroethylene. Concentrations of up to 10 ppb (methylene chloride) were detected, which is above federal drinking water standards. According to the study, the alleged source of contamination for the area was the former U.S. Chemical Corporation, a nearby facility. In 1990, onsite sediment samples taken by CT DEP indicated that there was low-level VOC sediment contamination from the unnamed brook that flows along the southeastern boundary of the Oslo property, at a maximum of 2 ppb (1,1,2,2-tetrachloroethane and tetrachloroethylene). In addition, soil samples indicated VOC contamination (xylene, toluene, and dichloroethane) at a maximum of 35 ppb (xylene), which is well below Connecticut's Remediation Standard Regulations (CT RSRs) for industrial soil of 1,000 ppm. CT DEP sampled onsite groundwater wells in 1990 and found onsite groundwater VOC contamination had decreased to even lower levels (maximum of 0.7 ppb of trichlorofluoroethylene), which is well below state and federal guidelines. Further onsite groundwater sampling performed in 1994 revealed that the VOC contamination has remained the same, at a maximum of 0.7 ppb (trichlorofluoroethylene). Because the contaminants from the facility have only been found onsite and only at low levels, it is not likely that this site presented an exposure or health hazard to the residents of Cheshire. It is unlikely to have affected the public water supply because the site is not on the same aquifer as the public water supply.

Peerless Screw

Peerless Screw, located at 286 Sandbank Road in Cheshire, is a machine shop. It is known that the water supply at Peerless Screw has been contaminated with low levels of 1,1,1-trichloroethane since 1979, at concentrations up to 15 ppb (μg/L). A 1985 water quality study by the Chesprocott Health District in the nearby area indicated that onsite groundwater was contaminated with low levels of methyl chloride, trichloroethylene, and tetrachloroethylene. The study found concentrations up to 6.1 ppb for trichloroethylene, which is above current drinking water standards. According to the study, the alleged source of contamination for the area was the former U.S. Chemical Corporation. In a Final Screening Site Inspection by CT DEP and EPA in 1990, groundwater results onsite indicated that the level of contamination have decreased greatly, to the point at which all of the contaminants (1 ppb trichloroethylene) detected were below federal or state guidelines. In the same inspection in 1990, however, 1,1,1-trichloroethane and methylene chloride was detected in soil onsite at concentrations up to 11 ppb. That contamination resulted from a surface outbreak of waste water in the area of the company's septic system, but the contaminants were not found in the site's water supply. These VOC levels in soil are greatly below the CT RSRs. Further onsite groundwater sampling performed by CT DEP in 1994 indicated that VOC contaminant levels remained below federal or state guidelines. In conclusion, it is possible that local private wells in the area may have been tained by groundwater contamination from this site. However, the general population of

Cheshire using public water would not be exposed because this site is not located on the same aquifer as the public water supply.

Suburban Excavators

Suburban Excavators, located at 1070 South Main Street, is involved in excavation and construction work and maintains vehicles on the site. Until 1982, Suburban Excavators discharged steam cleaning and vehicle-washing wastewater containing solvents into the ground via a drain in the floor. In 1982, groundwater containing VOCs was detecting in the south Cheshire well field about 0.6 miles south of Suburban Excavators. In that same year, although the source of pollution was tentatively traced to another source, CT DEP issued a pollution abatement order to the property. Under this order, the site was required to stop discharging solvent-bearing wastewater to the ground. In addition, groundwater analysis by CT DEP indicated that there was no contamination in the soil. Several contaminants were detected in the drain discharge, one at concentrations that exceeded state and federal drinking water standards (trichloroethylene at 63 ppb). Groundwater sampling by a consulting firm in 1982 indicated the presence of tetrachloroethylene and chloroform at concentrations up to 32 ppb (trichloroethylene). After the company sealed the floor drains (1982) and hooked up to the town’s sewer system in 1985, the state concluded that Suburban Excavators fulfilled all of the requirements of the order and that no remediation was necessary. The company has quit discharging contaminants to the ground and the company’s consultant found no soil contamination onsite since 1982, so it is unlikely that the facility is presently a source of groundwater contamination.

Superior Steel Products

Superior Steel Products, located on 1855 Peck Lane in Cheshire, is a machine shop that manufactures steel dye sets, special machines, and other steel products. The company has been in operation since 1960. The facility’s manufacturing processes include welding, grinding, drilling, milling, boring, honing, sand blasting, assembling, and painting of steel. Superior Steel’s grinding and machining wastes include an alkaline cutting and grinding fluid, “Cimcool” (trade name), and “Rust Lick,” a semi-synthetic, water soluble oil and coolant resistant to bacteria. During the machining process, metal shavings mix with solvents and quenching oil to become grinding sludge.

From 1960–1980, the company dumped “waste water-soluble oil” grinding sludge and paint onsite in the area currently occupied by its south parking lot. The liquid would soak into the ground, leaving dried grinding sludge. The sludge and oil were later used as fill for the onsite parking lot and the disposal area was covered with a paved parking area in 1980. DEP records indicate that Superior Steel Products was in violation of the Cheshire Inland Wetlands Regulations for filling the wet area west of the parking lot.

In November 1977, a CT DEP inspection revealed two pipes leading from grinding machines to an unnamed brook on the property. The same inspection revealed that approximately 1,500 gallons of “waste water-soluble oil” were dumped into the brook two times a year and 10–15 55-gallon drums filled with this same substance were being stored onsite along the bank of the brook. Several cubic feet of spent grinding sludge were used to build up the area behind the building and adjacent to the brook and may have been 1–2 feet thick in some areas. A later inspection by an EPA contractor in 1989 failed to locate this brook on the property.

After 1980, grinding sludge was either disposed of in a dumpster or stored in one of two 4,000-gallon underground tanks. Between 1980 and 1983, "waste water-soluble oil" was stored in two 4,000-gallon in-ground tanks, then transported off the property by a licensed waste hauler. In 1983, the Town of Cheshire submitted a letter to the CT DEP requesting that Superior Steel and 20 other commercial and industrial properties in the town be investigated for illegally disposing of solvents, cutting and lubricating oils, acids, transformer fluids, and paints in the septic systems, drywells, and catch basins. In February 1984, CT DEP performed a hazardous waste checklist on the property and noted onsite disposal of grinding sludge and soluble oils. In March 1984, CT DEP performed an inspection of Superior Steel at the request of the Inland Wetlands Commission of the Town of Cheshire. The inspection noted no problems on the property.

A leachfield and two dry wells are located on the property. As noted in an EPA contractor report in 1988, when the leachfield was in use, the wells would often overflow. CT DEP records noted that a leachfield and septic tank were in use until 1986. Currently, this property is served by public water and sewer.

Notes from the Chesprocott Health Department for Greg Manufacturing (524 West Johnson), a property adjacent to Superior Steel, indicated that low levels of VOCs were detected at or below state and federal drinking water levels in the onsite well in 1982. Those VOC levels included 5.4 ppb of trichloroethylene, 0.63 ppb of 1,1,1-trichloroethane, 5.4 ppb of chlorodibromomethane, 7.4 ppm of chloroform, 0.19 ppb of tetrachloroethylene and 0.05 ppb of 1,2-dichloropropene and 2,3-dichloropropene. Greg Manufacturing is believed to be located upgradient to Superior Steel, thus contaminated groundwater from the Greg Manufacturing property could affect the Superior Steel Property.

In 1989, onsite soil and tap water samples by an EPA contractor did not indicate the presence of VOCs at Superior Steel and only mercury and zinc were detected in the tap water samples. These levels, however, were below state and federal drinking water standards. Tap water samples taken about a month later did not indicate the presence of mercury. There are no records of Superior Steel using zinc or mercury on the property.

In 1991, samples of grit and steel slag from the Superior Steel Property detected barium and chromium at levels below CT RSRs.

In April 1995, an EPA contractor sampled shallow and deep soil and groundwater on the Superior Steel property. Shallow soil samples four feet or less) indicated the presence of total petroleum hydrocarbons (TPH) and three of 13 samples exceeded the CT Remediation Standard Regulations (CT RSRs) for industrial soils. Toluene was the only VOC detected in one sample and the concentration was below CT RSRs for industrial soils. Deep soil samples (more than 4 feet) also taken during this time indicated the presence of TPH but all of the sample concentrations were below CT RSRs for industrial soils. A moderate level of polychlorinated biphenyls (PCBs) was detected in one sample, but it did not exceed CT RSRs for industrial soils. In a 1995 Phase I and II Environmental Site Assessment, an EPA contractor reported the presence of a transformer that was labeled as a PCB contaminant (50–500 ppm) and some staining was noted on the pad. This transformer may have contributed to the PCB contamination in the soil. Methylene chloride was the only VOC detected in one sample, but the concentration did not exceed CT RSRS for industrial soils. Onsite groundwater samples indicated the presence of toluene, ethylene benzene, and xylene in several of the samples, but all concentrations were below state and federal drinking water standards. TPHs were also detected in the onsite groundwater samples and 8/20 exceeded the Groundwater Protection Criteria in the Connecticut Remediation Standard Regulations (CT RSRs).

There are reported to be about three houses within 50 feet of the property, but there is no record of the addresses of these residences. However, in a 1994 EPA contractor groundwater sampling survey on the nearby Airpax Corporation, Plant I, samples from four private residential wells in the next block (1700s) did not indicate the presence of contamination or the contamination was at very low levels and well below federal and state drinking water standards (1.0 or 1.1 ppb of 1,1,1-trichloroethane), so it is highly probable that the contamination from this site has not impacted the nearby area. With regard to the public water supply, this site is not on the same aquifer as the public water supply so it would have no impacts on public water.

TRW-DOT Division

The TRW-DOT Fastener Division Property, located at 250 Knotter Drive, manufactured snap fasteners on the property from 1974–1980. Materials used in their manufacturing process included metals (zinc, copper, lead, cadmium, nickel, chromium, tin, and iron), plating solutions, acids, and cyanide. From 1974–1978, TRW-DOT deposited metal hydroxide sludge into the two former unlined filter beds for dewatering.

From 1984 to present, the property now leased by Allied Signal Aerospace Company, has been utilized to manufacture gyroscopes. Operations include assembly, metal plating, and precision cleaning. The following wastes have been generated at the property from 1984 to the present: acetone, copper-cyanide filters, copper plating solutions, cyanide solutions, electrous nickel, electro polish (chromic-formic acid), epoxy, gold filters, ion resin, dichloromethane solution, metal hydroxide sludge, waste/oil/water mixtures, oil spill debris, oil and barium waste mixtures, silicon fluid, sodium nitrate, toluene, waste detergent, and waste tube oil. From 1984 to 1993, 1,1,1-trichloroethane and freon were used for cleaning purposes. 1,1,1-trichloroethane was stored in two 550-gallon above ground storage tank (AST) on the property and were removed when 1,1,1-trichlorethane use was discontinued in 1993. Allied now uses aqueous cleaners. Hazardous waste that is generated is drummed and stored in a concrete lined, bermed (earth-sheltered), placed in a hazardous waste storage area, and removed from the property on a biweekly basis.

Analysis of filter sand samples taken by the CT State Department of Health in December of 1978 and January 1979 from a filter bed that was used to filter metal hydroxide sludge indicated the presence of cyanide at levels up to 930 ppm, which is well below the CT RSR of 41,000 ppm for industrial soils. The filter beds were used from 1974–1978 to filter metal hydroxide sludge. Low levels of cadmium, zinc, chromium, lead and manganese were also detected. At that that time, there was some concern by the CT Department of Environmental Protection (CT DEP) that the contaminants found in the sand beds may contaminate groundwater that is used for public and private well drinking water supplies. Therefore, in January 1979, 500 cubic yards of filter bed sands were excavated and disposed of at the Cheshire landfill. By 1989, the majority of the filter beds were now covered by asphalt. Further soil samples taken later of filter bed sands of the property in 1989 indicated heavy metals at much lower levels than in 1978 and toluene (not previously found in 1979) which were well below the CT RSRs for soil. Soil sampling in 1990 indicated that only heavy metals were present in the soil on the former TRW-DOT property and they remained below CT RSRs. Another series of samples taken in 1995 indicated that heavy metals remained below CT RSRs, but PAHs and pesticides/polychlorinated biphenyls (PCBs) such as 4, 4-DDT were also present. It was suggested by the contractor that the pesticides/PCBs may have been likely used for plant and insect control and not related to on-site processes. PAHs found in the samples were also suggested by the contractor to be due to parking lot and roof runoff and not known to be used in on-site processes or on-site disposal. Even though two groundwater monitoring wells were installed on the former TRW-DOT property, groundwater sampling was never performed. There is a possibility that someone with a nearby residential well may have been impacted by the site because the contaminants in the soil may have leached into the groundwater in the past. With regard to the general Cheshire population, the public water supply would not be impacted by this site because it is located on a different aquifer from the public water supply. Because of limited sampling in the past, investigation of soil and groundwater at this site is planned for 2004.

U.S. Chemical Corporation

U.S. Chemical Corporation, located at 264 Sandbank Road, was a manufacturer of detergent type cleaners and paint strippers produced by blending raw chemicals (liquid and powder) with water on the premises. Numerous chemicals, including freon and compounds of alcohols, ethers, phosphates, and sodium, were used in their processes. A 4,000-gallon, above ground tank containing methylene chloride was also stored and used on the site. U.S. Chemical Corporation was the first tenant at this location and remained there for 19 years until they relocated to Southington, Connecticut, in 1982. In 1979, samples taken from the septic system by CT DEP indicated the presence of pentane at 2 ppm, iso-octane at 70 ppb, trichloroethylene at 10 ppb, toluene at 10 ppb, ethyl benzene at 10 ppb, m-xylene at 10 ppb, and o-xylene at 10 ppb. According to a groundwater study by the Chesprocott Health District in 1985, onsite groundwater samples were contaminated with low levels of VOCs. According to the study, the alleged source of contamination for the area was this company. Soil samples taken by CT DEP near the historic methyl chloride tank were found to be contaminated with several VOCs including 1,1,2,2-trichloroethane, tetrachloroethylene, and trichloroethylene at concentrations up to 19 ppb (tetrachloroethylene and 1,1,2,2-trichloroethane). In summary, a local resident with a private well may have been exposed to contaminated groundwater from U.S. Chemical Corporation in the past. However, the greater Cheshire population would have no exposure to groundwater contaminants from this site through public drinking water because the site is located on a different aquifer from the public water supply.

604 West Johnson Site (AKA Cheshire Groundwater Contamination or Cheshire Associates)

The 604 West Johnson site is a 15-acre former National Priorities List (NPL) site currently owned by Leiner-Feinerman Cheshire Trust. It was removed from the NPL in 1997. Groundwater and soil contamination by VOCs were probably caused by past disposal practices of two manufacturers of plastic molding that occupied the site, Valley National Corporation (1966–1979) and Cheshire Molding Company (1979–1980) (ATSDR, 1990). In 1983, 20 cubic yards of soil contaminated with

VOCs was removed to an EPA-regulated landfill. EPA sampling detected VOCs above current drinking water standards in onsite groundwater monitoring wells in 1983 and 1985 and in two private wells in residences near the site. The VOC levels in the private wells were either below detectable levels or below current drinking water standards. One of the private wells was later capped and both residences were transferred to the public water supply in 1987. Therefore, the well contamination from this site no longer poses a health risk to occupants of those residences. Because this site is on a different aquifer from the public water supply, this site would have no impacts on public water in Cheshire.

Appendix D

Historical Drinking Water Standards and Guidelines

Contaminant Abbreviation	Full Chemical Name	1979 SNARLS^ (ppb)		1984 CT DPH Health Advisory	1988 CT DPH Max. Contaminant Levels for VOCs (ppb)	1994 CT DPH MCL (ppb)
		1 day	<1 year			
DCP	dichloropropane	—	—	10	10	5
TCE	trichloroethylene	225	25		5	5

^Suggested No Adverse Response Level

Appendix E

Calculations for TCE Concentrations for Years 1974–1989

Scenario A

1974–1978

Between the years 1974 and 1978, Cheshire residents could have received drinking water from the north Cheshire well field (wells #1 and #4) and/or from the Prospect Reservoir. We assume that the north Cheshire well field was contaminated with trichloroethylene (TCE) during this period, even though water sampling did not begin until 1979. The Prospect Reservoir was never contaminated with TCE. There are three possible combinations of drinking water that Cheshire residents could have received during 1974–1978. We do not have the information to allow us to determine, for a given household, which combination of water they actually received:

1) Residents could have received all of their drinking water from the Prospect Reservoir (which had no contamination).
2) Residents could have received a mixture of water from the north Cheshire well field (wells #1 and #4) and Prospect Reservoir.
3) Residents could have received all of their water from the north Cheshire well field (wells #1 and #4).

In calculating exposure concentrations for the years 1974–1978, we assumed that residents received a mixture of water from the north Cheshire well field and Prospect Reservoir. This is not as conservative as assuming that residents received all of their water from the north Cheshire well field. However, we believe it is a more realistic assumption because if there were households who received only the contaminated water from the north Cheshire well field, the numbers of households were likely very small. It is more likely that the majority of households in Cheshire received a mixture of north Cheshire wellfield water and Prospect Reservoir water.

The relative contribution from each source was determined based on available information on the total draft for the year (i.e., the total amount of water, in gallons, pumped from the source). The relative contribution of each of the two wells in the north Cheshire well field was determined in the same way. It was further assumed that the water from the different sources was completely mixed (i.e., evenly blended) before being distributed to residents.

Average Concentration for North Cheshire Well field 1974–1978

For wells #1 and #4, we begin with the average TCE concentration for each well from 1979 because that is the first year sampling data are available. The relative contribution of water from each well is 2 to 1. That is, for every 2 gallons pumped from well #1, 1 gallon was pumped from well #4. This assumption is based on pump rated capacities for each well as described in Table 1 of this document. Although the total amounts pumped (total draft) differ from year to year, the ratio between wells #1 and #4 remains the same. The general equation for this calculation is shown below.

General Equation:
[(Ave. conc. well #1 * Draft from well #1) + (Ave. conc. well #4 * Draft from well #4)]/Total draft from #1 and #4 = Annual average TCE concentration from north Cheshire well field (wells #1 and #4).

[(30.44 µg/L * 2 Gal) + (68.66 µg/L * 1 Gal)]/3 Gal = 43.18 µg/L

Estimated Average Concentration in water received by Cheshire residents

As stated above, we assume that residents received water from both the north Cheshire well field and the Prospect Reservoir. The calculations below show the final TCE concentration after dilution of contaminated well field water with clean water from Prospect Reservoir.

General Equation:
(Ave. conc. N. Cheshire well field * Total draft N. Cheshire well field)/total draft N. Cheshire well field and Prospect Reservoir)

<u>Year 1974</u>
(43.18 µg/L* 217.9E6 Gal)/627.4E6 Gal = **15 µg/L**

<u>Year 1975</u>
(43.15 µg/L*179.9E6 Gal)/607.4E6 Gal = **12.7 µg/L**

<u>Year 1976</u>
(43.18 µg/L*402.6E6 Gal)/588.6E6 Gal **= 29.53 µg/L**

<u>Year 1977</u>
(43.18 µg/L*542.6E6 Gal)/626E6 Gal **= 37.43 µg/L**

<u>Year 1978</u>
In this year, there was no dilution of north Cheshire well water because Prospect Reservoir was taken offline. Therefore, **43.15 µg/L** (the average from the north Cheshire well field) is the TCE concentration for the year 1978.

From 1978 to 1982, there was some contribution from south Cheshire wells as they went online beginning in 1978. Water from south Cheshire wells was not considered in calculating average concentrations from 1978–1982 because their contribution was generally very small, relative to north Cheshire wells, and would not change the overall average concentration significantly.

<u>Year 1979</u>
In the calculation for this year, we did not use the relative contribution of 2:1 for wells #1 and #4 that was used in previous calculations. The ratio was changed to 4:1 to account for the fact that well #4 was only used for 6 months.

[(Ave. conc. well #1 * Draft from well #1) + (Ave. conc. well #4 * Draft from well #4)]/Total draft from #1 and #4 = Annual average TCE concentration from north Cheshire well field (wells #1 and #4).

[(30.44 µg/L*4 Gal)+(68.66 µg/L*1 Gal)]/5 Gal = **38.08 µg/L**

<u>Year 1980</u>
The calculation for this year also uses the 4:1 ratio.

(6.23 µg/L)*4 Gal) + (10.7 µg/L*1 Gal)/5 Gal = **7.13 µg/L**

<u>Year 1981</u>
This calculation uses the 2:1 ratio because well #4 was online for a full 12 months

(2.92 µg/L*2 Gal) + (1.41 µg/L*1Gal)/3 Gal = **2.41 µg/L**

<u>Year 1982</u>
This calculation uses the 2:1 ratio because well #4 was online for a full 12 months

(1.8 µg/L*2 Gal) + (5.92 µg/L*1)/3 Gal = **3.17 µg/L**

<u>Years 1983-1989</u>
Average yearly finished water concentrations were used. See Appendix E, Table 1

Appendix E, Table 1. Average Concentrations for North Cheshire Well field 1974–1989

Year	Average Concentration (µg/L)
1974	15.00
1975	12.78
1976	29.53
1977	37.43
1978	43.15
1979	38.08
1980	7.13
1981	2.41
1982	3.17
1983	5.7
1984	3.48
1985	7.2
1986	9.61
1987	1.21
1988	0.6
1989	0.23
Average	**13.54**

Appendix F
Scenario B Calculated TCE Concentrations

Calculations for TCE Concentration from 1959 to 1978

Average Concentration for North Cheshire Well field and Prospect Reservoir 1959–1973

For well #1, we begin with the average TCE concentration for each well from 1979 because that is the first year sampling data are available. The total amounts pumped differ from year to year. The same calculation assumptions are followed for the years 1959–1973 as in 1974–1978 except that the north Cheshire well field has only one well online, well #1. The general equation for this calculation is shown below.

General Equation:
[(Ave. conc. well #1 * Draft from well #1) /(Total draft from well #1 and Prospect Reservoir)] = Annual average TCE concentration from north Cheshire well fields and Prospect Reservoir

Year 1959

(30.44 µg/L*4.8E6 Gal)/282E6^ Gal = **10.23 µg/L**

^Since no information on total draft of the north Cheshire well field existed this year, total draft from 1960 is assumed.

Year 1960

(30.44 µg/L*94.8E6 Gal)/253.5E6 = **11.38 µg/L**

Year 1961

(30.44 µg/L*15.9E6 Gal)/219.8E6 Gal = **2.20 µg/L**

Year 1962

(30.44 µg/L*107.7E6 Gal)/324.7E6 Gal = **10.10 µg/L**

Year 1963

(30.44 µg/L*189.5E6 Gal)/386E6 Gal = **14.95 µg/L**

Year 1964

(30.44 µg/L*184.5E6 Gal)/411.2E6 Gal l = **13.66 µg/L**

Year 1965

(30.44 µg/L*170.1E6 Gal)/398.5E6 Gal = **12.99 µg/L**

<u>Year 1966</u>

(30.44 µg/L*173.7E6 Gal)/366.6E6 Gal * = **14.42 µg/L**

<u>Year 1967</u>

(30.44 µg/L*54.2E6 Gal)/336E6 Gal = **4.91 µg/L**

<u>Year 1968</u>

(30.44 µg/L*170.8E6 Gal)/479.8E6 Gal = **10.84 µg/L**

<u>Year 1969</u>

(30.44 µg/L*258E6 Gal)/439.7E6 Gal = **17.86 µg/L**

<u>Year 1970</u>

(30.44 µg/L*178.9E6 Gal)/552.3E6 Gal = **9.86 µg/L**

<u>Year 1971</u>

(30.44 µg/L*262.5E6 Gal)/522.8E6 Gal = **15.28 µg/L**

<u>Year 1972</u>

(30.44 µg/L*196.4E6 Gal)/559.8E6 Gal = **10.68 µg/L**

<u>Year 1973</u>

(30.44 µg/L*254.2E6 Gal)/651.9E6 Gal = **11.87 µg/L**

<u>Years 1974-1989</u>

The same assumptions and concentration from Scenario A are used.

Appendix F. Table 1. Average TCE Concentration for Years 1959–1989, assuming that water is from the North Cheshire Well field and Prospect Reservoir

Year	**TCE Concentration (ppb)**
1959	10.23
1960	11.38
1961	2.20
1962	10.10
1963	14.95
1964	13.66
1965	12.99
1966	14.42
1967	4.91
1968	10.84
1969	17.86
1970	9.86
1971	15.28
1972	10.68
1973	11.87
1974	15.00
1975	12.78
1976	29.53
1977	37.43
1978	43.18
1979	38.08
1980	7.13
1981	2.41
1982	3.17
1983	5.7
1984	3.48
1985	7.2
1986	9.61
1987	1.21
1988	0.6
1989	0.23
Average	**12.51**

Appendix G
TCE Dose and Risk Calculations

Noncancer Ingestion Dose

1) Trichloroethylene, Scenario A
1a) Noncancer Risk Child, age 1–6 years
In the following calculations, we are estimating the average daily dose of TCE a child, age 1–6 years would receive from water by ingestion, inhalation, and through the skin (dermally) using assumptions from scenario A.

$1a_1$) Ingestion Dose age 1–6 years:
$ADD_c = IR_c$*[water]*ED* 1/BW*1/AT_{nc}
ADD_c = 1 L/day*13.54 µg/L*6 yr*1/16 kg*1/6 yr = **0.84 µg/kg/day or 8.4E-4 mg/kg/day**

$1a_2$) Inhalation Dose Child Age 1–6 yrs:
Shower/bath:
ADD_{ins} = [water]*C1*C2*I_{in}R*C3*C4*ED*1/BW*1/AT_{nc}
ADD_{ins} = (13.54 µg/L*(0.1 µg/m^3/µg/L) *58*0.0083m^3/min*15 min/event*1 event/day *6 years*1/16 kg*1/6 yr = **0.61 µg/kg/day or 6.1E-4 mg/kg/day**

Household air:
ADD_{inh} = [water]*C1*I_{in}R*C4*C5*ED*1BW*1/AT_{nc}
ADD_{inh} = (13.54 µg/L*(0.1 µg/m^3/(µg/L))*0.0083 m^3/min*960 min/event*1 event/day*6 yr*1/16 kg*1/6 yr = **0.67 µg/kg/day or 6.74 E-4 mg/kg/day**

Total Inhalation Dose Child
Total Inhalation Dose Child (ADD_{in}) = ADD_{ins} + ADD_{inh}
= 0.61 µg/kg/day + 0.67 µg/kg/day
= **1.28 µg/kg/day or 1.28E-3 mg/kg/day**

$1a_3$) Dermal Dose Child:
The dermal dose is estimated to be the same as the ingestion dose [2]: **0.84 µg/kg/day**
ADD_d = 0.84 µg/kg/day

$1a_4$) Noncancer Hazard Index Child Scenario A
HI = ADD_d+ADD_i + ADD_{in}/Rfd
HI = (0.84 µg/kg/day+0.84 µg/kg/day+ 1.28 µg/kg/day)/0.3 µg/kg/day = **9.87**

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[2] A 1993 modeling analysis conducted by CT DPH evaluated various exposure routes stemming from groundwater contamination with the related chlorinated solvent, perchloroethlyene (PERC) (Rao and Brown, 1993). That analysis estimated that dermal and ingestion exposure doses would be approximately equal when expressed on an internal dose basis (PERC levels in blood or brain).

A Hazard Index of 1 means that the estimated dose is equal to the safe dose. A Hazard Index less than 1 indicates that the estimated dose is below the safe dose and noncancer health impacts are unlikely. A Hazard Index greater than 1 indicates that the estimated dose is above the safe dose and noncancer health impacts cannot be ruled out. In this case, Health Indices for TCE are above 1. This indicates that noncancer health impacts from TCE exposure cannot be ruled out.

1b) Cancer Risks, child/adult age 1–16 years

In these calculations, we are estimating the lifetime average daily dose of TCE a child/adult age 1–16 years would receive from inhalation, ingestion, and through the skin (dermally) using exposure assumptions from scenario A.

$1b_1$) Ingestion Dose—TCE, Scenario A

$LADD_c$ = IR_c*[water]*ED* 1/BW*1/AT_c

$LADD_c$ = 1 L/day*13.54 µg/L*6 yr*1/16 kg*1/70 yr = **0.073 µg/kg/day or 7.3E-5 mg/kg/day**

$LADD_a$ = IR_a*[water]*ED* 1/BW*1/AT_c

$LADD_a$ = 2 L/day*13.54 µg/L*10 yr*1/70 kg*1/70 yr = **0.055 µg/kg/day or 5.53E-5 mg/kg/day**

$1b_2$) Inhalation Dose

Showering/Bathing:

$ADDC_{ins}$ = [water]*C1*C2*I_{in}R*C3*C4*ED*1/BW*1/AT_c

$ADDC_{ins}$ = (13.54 µg/L*(0.1 µg/m^3/µg/L)*58*0.0083 m^3/min*15 min/event*1 event/day *6 years*1/16 kg*1/70 yr = **0.052 µg/kg/day or 5.24E-5 mg/kg/day**

$ADDA_{ins}$ = [water]*C1*C2*I_{in}R*C3*C4*ED*1/BW*1/AT_c

$ADDA_{ins}$ = (13.54 µg/L*(0.1 µg/m^3/µg/L)*58*0.0139 m^3/min*15 min/event*1 event/day *10 years*1/70 kg*1/70 yr = **0.033 µg/kg/day or 3.34E-5 mg/kg/day**

Household Air:

$LADDC_{inh}$ = [water]*C1*I_{in}R*C4*C5*ED*1BW*1/AT_c

$LADDC_{inh}$ =13.54 µg/L*(0.1 µg/m^3/(µg/L))*0.0083 m^3/min*960 min/event*1 event/day*6 yr*1/16 kg*1/70 yr = **0.058 µg/kg/day or 5.78E-5 mg/kg/day**

$LADDA_{inh}$ = [water]*C1*I_{in}R*C4*C5*ED*1BW*1/AT_c

$LADDA_{inh}$ = (13.54µg/L*(0.1µg/m^3/(µg/L))*0.0139 m^3/min*960 min/event*1 event/day*10 yr*1/70 kg*1/70 yr = **0.037 µg/kg/day or 3.69E-5 mg/kg/day**

Total Inhalation Dose

Total Inhalation Dose Child/Adult (ADD_{in}) = ADD_{ins} + ADD_{inh}

0.058 µg/kg/day + 0.037 µg/kg/day + 0.052 µg/kg/day + 0.033 µg/kg/day

$LADD_{in}$ = **0.18 µg/kg/day or 1.8E-4 mg/kg/day**

$1b_3$) Dermal Dose:
Assume dose is approximately equal to ingestion dose[2]
$LADDC_d$: 0.073 µg/kg/day
$LADDA_d$: 0.055 µg/kg/day

$1b_4$) Excess Lifetime Cancer Risk
ELCR = ($LADDC_d$ + $LADDA_d$ + $LADDA_i$ + $LADDC_i$ +$LADD_{in}$)*CSF
= 0.073 µg/kg/day + 0.055 µg/kg/day + 0.073 µg/kg/day + 0.055 µg/kg/day + 0.18 µg/kg/day)*20-400 µg/kg/day
= 4.36E-4 mg/kg/day*0.02-0.4 mg/kg/day
ELCR = 8.72E-6 to 1.7E-4

The Estimated Lifetime Risk for TCE using exposure assumptions from scenario A ranges from 8.72 E-6 (8.72 in 1,000,000) to 1.7 E-4 (1.7 in 10,000). The maximum estimated risk of 1.7 in 10,000 means that if 10,000 people were exposed to TCE at the concentration, frequency, and duration of exposure assumed in the calculation detailed above, there would be a theoretical increase of 1.7 cancers above the number of cancers that would normally be expected to occur in the population of 10,000. Background rates of cancer in the United States are one in 2 or 3 (NCI 2001). This means that in a population of 10,000, background numbers of cancer cases would be approximately 3,300 to 5,000. TCE exposures could result in a theoretical increase of cancer cases above the background number of 3,300 to 5,000 cancer cases. This represents a low increased cancer risk.

2) Scenario B

2a) Noncancer Risk Child age 1–6 years
In the following calculations, we are estimating the average daily dose of TCE a child, age 1–6 years would receive from water by ingestion, inhalation, and through the skin (dermally) using assumptions from scenario B.

$2a_1$) Ingestion Dose age 1–6 years:
$LADD_c$ = IR_c*[water]*ED* 1/BW*1/AT_{nc}
LADDc = 1L/day*12.51 µg/L*6 yr*1/16 kg*1/6 yr = **0.78 µg/kg/day or 7.82E-4 mg/kg/day**

$2a_2$) Inhalation Dose Child Age 1–6 yrs:
Shower/bath:
ADD_{ins} = [water]*C1*C2*I_{in}R*C3*C4*ED*1/BW*1/AT_{nc}
ADD_{ins} = (12.51 µg/L)*(0.1 µg/m^3/µg/L)*58*0.0083 m^3/min*15 min/event*1 event/day *6 years*1/16 kg*1/6 yr = **0.56 µg/kg/day or 5.65E-4 mg/kg/day**

Household air:
ADD_{inh} = [water]*C1*I_{in}R*C4*C5*ED*1BW*1/AT_{nc}
ADD_{inh} = (12.51 µg/L*(0.1 µg/m^3/(µg/L))*0.0083 m^3/min*960 min/event*1 event/day*6 yr*1/16 kg*1/6 yr **= 0.62 µg/kg/day or 6.23 E-4 mg/kg/day**

Total Inhalation Dose Child
$ADD_{in} = ADDA_{ins} + ADDA_{inh}$
= 0.56 µg/kg/day + 0.62 µg/kg/day
= **1.18 µg/kg/day or 1.18E-3 mg/kg/day**

$2a_3$) Dermal Dose Child:
Dermal dose is estimated to be the same as the ingestion dose[2]
ADD_d = 0.78 µg/kg/day

$2a_4$) Noncancer Hazard Index Child Scenario B
$HI = ADD_d + ADD_i + ADD_{in}/Ref_d$
HI = (0.78 µg/kg/day+0.78 µg/kg/day+ 1.18 µg/kg/day)/0.3 µg/kg/day = **9.13**

A Hazard Index of 1 means that the estimated dose is equal to the safe dose. A Hazard Index less than 1 indicates that the estimated dose is below the safe dose and noncancer health impacts are unlikely. A Hazard Index greater than 1 indicates that the estimated dose is above the safe dose and noncancer health impacts cannot be ruled out. In this case, Health Indices for TCE are above 1. This indicates that noncancer health impacts from TCE exposure cannot be ruled out.

2b) Cancer Risks, child/adult age 1–30 years

In these calculations, we are estimating the lifetime average daily dose of TCE a child/adult age 1–30 years would receive from inhalation, ingestion, and through the skin (dermally) using exposure assumptions from scenario B.

$2b_1$) Ingestion Dose Scenario B:

$LADD_c = IR_c$*[water]*ED* 1/BW*1/AT_c
$LADD_c$ = 1 L/day*12.51 µg/L*6 yr*1/16 kg*1/70 yr = **0.067 µg/kg/day or 6.70E-5 mg/kg/day**

$LADD_a = IR_a$*[water]*ED* 1/BW*1/AT_c
$LADD_a$ = 2 L/day*12.51 µg/L*25 yr*1/70 kg*1/70 yr = **0.128 µg/kg/day or 1.28E-4 mg/kg/day**

$2b_2$) Inhalation Dose
Showering/Bathing:

$LADDC_{ins}$ = [water]*C1*C2*I_{in}R*C3*C4*ED*1/BW*1/AT_c
$LADDC_{ins}$ = (12.51 µg/L*(0.1 µg/m^3/µg/L)*58*0.0083 m^3/min*15 min/event*1 event/day *6 years*1/16 kg*1/70 yr = **0.0484 µg/kg/day or 4.84E-5 mg/kg/day**

$LADDA_{ins}$ = [water]*C1*C2*I_{in}R*C3*C4*ED*1/BW*1/AT_c
$LADDA_{in}$ = (12.51 µg/L*(0.1 µg/m^3/µg/L)*58*0.0139 m^3/min*15 min/event*1 event/day*25 years*1/70 kg*1/70 yr = **0.077 µg/kg/day or 7.72E-5 mg/kg/day**

Household Air:
$LADDC_{inh}$ = [water]*C1*I_{in}R*C4*C5*ED*1BW*1/AT_c
$LADDC_{inh}$ =12.51 µg/L*(0.1 µg/m^3/(µg/L))*0.0083 m^3/min*960 min/event*1 event/day*6 yr*1/16 kg*1/70 yr = **0.053 µg/kg/day or 5.33E-5 mg/kg/day**

$LADDA_{inh}$= [water]*C1*I_{in}R*C4*C5*ED*1BW*1/AT_c
$LADDA_{inh}$ = (12.51 µg/L*(0.1 µg/m^3/(µg/L))*0.0139 m^3/min*960 min/event*1 event/day*25 yr*1/70 kg*1/70 yr = **0.085 µg/kg/day or 8.52E-5 mg/kg/day**

Total Inhalation Dose
$LADD_{in}$ = $LADDA_{ins}$ + $LADDA_{inh}$ + $LADDC_{ins}$ + $LADDC_{inh}$
0.0484 µg/kg/day + 0.077 µg/kg/day + 0.0533 µg.kg/day + 0.0852 µg/kg/day
$LADD_{in}$ = **0.26 µg/kg/day or 2.64E-4 mg/kg/day**

$2b_3$) Dermal:
Dermal Dose is approximately equal to ingestion dose[2]
$LADDC_d$**: 0.067µg/kg/day**
$LADDA_d$: **0.128 µg/kg/day**

$2b_4$) Excess Lifetime Cancer Risk
ELCR = ($LADDC_d$ + $LADDA_d$ + $LADDA_i$ + $LADDC_i$ +$LADD_{in}$)*CSF
= (0.067 µg/kg/day + 0.128 µg/kg/day + 0.067 µg/kg/day + 0.128 µg/kg/day + 0.26 µg/kg/day)*20-400 µg/kg/day
= 6.5E-4 mg/kg/day*0.02-0.4 mg/kg/day
ELCR = 1.3E-5 to 2.6E-4

The Estimated Lifetime Risk for TCE using exposure assumptions from scenario B ranges from 1.3 E-5 (1.3 in 100,000) to 2.6 E-4 (2.6 in 10,000). The maximum estimated risk of 2.6 in 10,000 means that if 10,000 people were exposed to TCE at the concentration, frequency and duration of exposure assumed in the calculation detailed above, there would be a theoretical increase of 2.6 cancers above the number of cancers that would normally be expected to occur in the population of 10,000. Background rates of cancer in the United States are one in 2 or 3 (NCI 2001). This means that in a population of 10,000, background numbers of cancer cases would be approximately 3,300 to 5,000. TCE exposures could result in a theoretical increase of cancer cases above the background number of 3,300 to 5,000 cancer cases. This represents a low increased cancer risk.

3) 1,2-Dichloropropane

3a) Noncancer Risk Child age 1–6 years:
(using maximum yearly sampling and averaging those concentrations)

In the following calculations, we are estimating the average daily dose of DCP a child, age 1–6 years would receive from water by ingestion, inhalation, and through the skin (dermally).

3a$_1$) = Ingestion Dose Child Age 1–6 years.
$ADD_i = IR*[water]*ED* 1/BW*1/AT_{nc}$
ADD_i = 1 L/day*6.22 µg/L*6 yr*1/16 kg*1/6 yr = **0.39 µg/kg/day**

3a$_2$) Inhalation Dose Child Age 1–6 yrs:
Shower/bath:
ADD_{in} = (6.22 µg/L*(0.1 µg/m^3/µg/L) *58*0.0083 m^3/min*15 min/event*1 event/day *6 years*1/16 kg*1/6 yr = 0.281 µ**g/kg/day or 2.81E-4 mg/kg/day**

Household air:
$ADD_{inh} = [water]*C1*I_{in}R*C4*C5*ED*1BW*1/AT_{nc}$
ADD_{inh} = (6.22 µg/L*(0.1 µg/m^3/(µg/L))*0.0083 m^3/min*960 min/event*1 event/day*6 yr*1/16 kg*1/6 yr = **0.310 µg/kg/day or 3.10 E-4 mg/kg/day**

Total Inhalation Dose Child
$ADD_{in} = ADD_{ins} + ADD_{inh}$
= 0.281 µg/kg/day + 0.310 µg/kg/day
= **0.591 µg/kg/day or 5.91E-4 mg/kg/day**

3a$_3$) Dermal Dose Child:
Dermal dose is estimated to be the same as the ingestion dose[2]
ADD_d = 0.39 µg/kg/day

3a$_4$) Noncancer Hazard Index Child
$HI = ADD_d+ADD_i + ADD_{in}/RfD$
HI = (0.39 µg/kg/day+0.39 µg/kg/day+ 0.59 µg/kg/day)/89 µg/kg/day = **0.015**

A Hazard Index of 1 means that the estimated dose is equal to the safe dose. A Hazard Index less than 1 indicates that the estimated dose is below the safe dose and noncancer health impacts are unlikely. A Hazard Index greater than 1 indicates that the estimated dose is above the safe dose and noncancer health impacts cannot be ruled out. In this case, Health Indices for DCP are less than 1. This indicates that noncancer health impacts from DCP exposure are unlikely.

3b) Cancer Risks, child age 1–6 years

3b$_1$) Ingestion Dose DCP:
(Using maximum yearly sampling and averaging those concentrations)

In these calculations, we are estimating the lifetime average daily dose of DCP a child age 1–6 years would receive from inhalation, ingestion, and through the skin (dermally).

$LADD_c = IR_c*[water]*ED* 1/BW*1/AT_c$
$LADD_c$ = 1 L/day*6.22 µg/L*6 yr*1/16 kg*1/70 yr = **0.033 µg/kg/day or 3.3E-5 mg/kg/day**

$3b_2$) Inhalation Dose
Showering/Bathing:
$LADDC_{ins}$ = [water]*C1*C2*I_{in}R*C3*C4*ED*1/BW*1/AT_c
$LADDC_{ins}$ = (6.22 µg/L*(0.1µg/m^3/µg/L)*58*0.0083 m^3/min*15 min/event*1 event/day *6 years*1/16 kg*1/70 yr = **0.024 µg/kg/day or 2.4E-5 mg/kg/day**

Household Air:
$LADDC_{inh}$ = [water]*C1*I_{in}R*C4*C5*ED*1BW*1/AT_{fc}
$LADDC_{inh}$ = 6.22 µg/L*(0.1 µg/m^3/(µg/L))*0.0083 m^3/min*960 min/event*1 event/day*6 yr*1/16 kg*1/70 yr = **0.027 µg/kg/day or 2.66E-5 mg/kg/day**

Total Inhalation Dose
$LADD_{in}$ = $LADD_{ins}$ + $LADD_{inh}$
$LADD_{in}$ = 0.024 µg/kg/day + 0.0267 µg/kg/day
$LADD_{in}$ = **0.05 µg/kg/day or 5.0E-5 µg/kg/day**

$3b_3$) Dermal:
Assume Dose is approximately equal to ingestion dose[2]
$LADD_d$: **0.033 µg/kg/day**

$3b_4$) Excess Lifetime Cancer Risk
ELCR = ($LADD_d$ + $LADD_i$ +$LADD_{in}$)*CSF
= (0.033 µg/kg/day + 0.033 µg/kg/day + 0.05 µg/kg/day)*3.6 $(µg/kg/day)^{-1}$
= 0.116 µg/kg/day*36 µg/kg/day
= 1.16E-4 mg/kg/day*3.6E-2 $(mg/kg/day)^{-1}$
ELCR = 4.18E-6

The Estimated Lifetime Risk for DCP is 4.18 E-6 (4.18 in 1,000,000). The maximum estimated risk of 4.18 in 1,000,000 means that if 1,000,000 people were exposed to DCP at the concentration, frequency and duration of exposure assumed in the calculation detailed above, there would be a theoretical increase of 4.18 cancers above the number of cancers that would normally be expected to occur in the population of 1,000,000. Background rates of cancer in the United States are one in 2 or 3 (NCI 2001). This means that in a population of 1,000,000, background numbers of cancer cases would be approximately 330,000 to 5,000,000. DCP exposures could result in a theoretical increase of 4.18 cancer cases above the background number of 330,000 to 500,000 cancer cases. This represents a low increased cancer risk.

WHERE:

[water] = TCE or DCP concentration where appropriate (in µg/L)
ADD_i = average daily dose from ingestion
ADD_{in} = Average Daily dose from inhalation
ADD_d = Average daily dose from dermal exposure
AT_{nc} = averaging time for noncancer risk; child-6 years
AT_c = averaging time for cancer risk; 70 years
BW = child 50th percentile body weight for age 1–6 years (ATSDR 1992); 16 kg, adult = 50th percentile body weight (ATSDR 1992); 70 kg
C1 = constant, household water to air ratio which is 0.1µg/m^3 per µg/L (Ginsberg 1999)
C2 = constant, 58, shower air concentration is 58 times higher than household air Concentration (Ginsberg 1999)
C3 = Constant, length of a shower event (Ginsberg 1999), 15 min/event
C4 = Constant, 1 event/day
C5 = Constant, length of an exposure event for household air, 960 min/event (Ginsberg 1999)
CSF = Cancer Slope Factor, for DCP based on CALEPA (1999) which is 3.6E-2 $(mg/kg/day)^{-1}$, for TCE the proposed EPA CSF is $(0.02–0.4\ mg/kg/day)^{-1}$ (EPA 2001).
ED = Exposure duration; 6 years for cancer child, 24 years for cancer child/adult
ELCR = Excess Lifetime Cancer Risk
HI = Hazard index; a measure of theoretical noncancer health risks
$I_{in}R$ = Inhalation rate child, 0.0083 m^3/min; 0.0139 m^3/min for an adult (Ginsberg 1999)
IR = Water ingestion rate child; 1 L/day, 2 L /day for an adult (EPA 1997)
$LADD_i$= Lifetime average daily dose from water ingestion for child, aged 1–6 years lifetime for adult, aged 7–30 years
$LADD_{in}$= Lifetime average daily dose from inhalation for child, aged 1–6 years lifetime for adult, aged 7–30 years
$LADD_d$= Lifetime average daily dose from dermal exposure for child, aged 1–6 years lifetime for adult, aged 7–30 years
Rfd = Noncancer based reference dose for DCP based on CALEPA (1999), which is 3E-4 mg/kg/day; for TCE, the Rfd is based on a proposed EPA Rfd of 0.3 µg/kg/day (EPA, 2001).

Appendix H

Risk Calculations for Private Wells near Alling Lander/County Wide Construction

Please refer to Appendix G for a key to symbols

Assuming 141 ppb of TCE
1a) Noncancer Risk Child age 1–6 years

$1a_1$) Ingestion Dose age 1–6 years:

$LADD_c = IR_c$*[water]*ED* 1/BW*1/AT_{nc}
LADDc = 1 L/day*141 µg/L*6 yr*1/16 kg*1/6 yr = **8.81 µg/kg/day or 8.81E-3 mg/kg/day**

$1a_2$) Inhalation Dose Child Age 1–6 years:
Shower/bath:
ADD_{ins} = [water]*C1*C2*I_{in}R*C3*C4*ED*1/BW*1/AT_{nc}
ADD_{ins} = (141 µg/L)*(0.1 µg/m^3/µg/L) *58*0.0083 m^3/min*15 min/event*1 event/day *6 years*1/16 kg*1/6 yr= **6.36 µg/kg/day or 6.36E-3 mg/kg/day**

Household air:
ADD_{inh} = [water]*C1*I_{in}R*C4*C5*ED*1BW*1/AT_{nc}
ADD_{inh} = (141 µg/L*(0.1 µg/m^3/(µg/L))*0.0083 m^3/min*960 min/event*1 event/day*6 yr*1/16 kg*1/6 yr **= 7.02 µg/kg/day or 7.02 E-3 mg/kg/day**

Total Inhalation Dose Child
ADD_{in} = $ADDA_{ins}$ + $ADDA_{inh}$
=6.36 µg/kg/day + 7.02 µg/kg/day
= **13.38 µg/kg/day or 13.38E-3 mg/kg/day**

$1a_3$) Dermal Dose Child:
The dermal dose is estimated to be the same as the ingestion dose: **8.81 µg/kg/day***
ADD_d = **8.81µg/kg/day**

$1a_4$) Noncancer Hazard Index Child
HI = ADD_d+ADD_i + ADD_{in}/Ref_d
HI = (8.81 µg/kg/day+8.81 µg/kg/day+ 13.38 µg/kg/day)/0.3µg/kg/day = **103.33**

1b) Cancer Risks, child/adult age 1-30
$1b_1$) Ingestion Dose:

$LADD_c = IR_c$*[water]*ED* 1/BW*1/AT_c
$LADD_c$ = 1L/day*141 µg/L*6 yr*1/16 kg*1/70 yr = **0.76 µg/kg/day or 7.55E-4 mg/kg/day**

$LADD_a = IR_a$*[water]*ED* 1/BW*1/AT_c
$LADD_a$ = 2 L/day*141 µg/L*19 yr*1/70 kg*1/70yr = **1.09 µg/kg/day or 1.09E-3 mg/kg/day**

$1b_2$) Inhalation Dose
Showering/Bathing:

$LADDC_{ins}$ = [water]*C1*C2*I_{in}R*C3*C4*ED*1/BW*1/AT_c
$LADDC_{ins}$ = (141 µg/L*(0.1 µg/m^3/µg/L) *58*0.0083 m^3/min*15 min/event*1 event/day *6 years*1/16kg*1/70yr = 0.55 **µg/kg/day or 5.45E-4 mg/kg/day**

$LADDA_{ins}$ = [water]*C1*C2*I_{in}R*C3*C4*ED*1/BW*1/AT_c
$LADDA_{in}$ = (141 µg/L*(0.1 µg/m^3/µg/L) *58*0.0139 m^3/min*15 min/event*1 event/day *19 years*1/70 kg*1/70 yr = **0.66** µ**g/kg/day or 6.61E-4mg/kg/day**

Household Air:
$LADDC_{inh}$ = [water]*C1*I_{in}R*C4*C5*ED*1BW*1/AT_c
$LADDC_{inh}$ = 141 µg/L*(0.1 µg/m^3/(µg/L))*0.0083 m^3/min*960 min/event*1 event/day*6 yr*1/16kg*1/70 yr = **0.60** µ**g/kg/day or 6.02E-4 mg/kg/day**

$LADDA_{inh}$ = [water]*C1*I_{in}R*C4*C5*ED*1BW*1/AT_c
$LADDA_{inh}$ = (141 µg/L*(0.1µg/m^3/(µg/L))*0.0139 m^3/min*960 min/event*1 event/day*19 yr*1/70kg*1/70 yr = **0.73 µg/kg/day or 7.30E-4 mg/kg/day**

Total Inhalation Dose
$LADD_{in} = LADDA_{ins} + LADDA_{inh} + LADDC_{ins} + LADDC_{inh}$
0.55 µg/kg/day + 0.66 µg/kg/day + 0.60 µg.kg/day + 0.73 µg/kg/day
$LADD_{in}$ = **2.54 µg/kg/day or 2.54E-3 µg/kg/day**

$1b_3$) Dermal:
Assume Dose is approximately equal to ingestion dose
$LADDC_d$: **0.76µg/kg/day**
$LADDA_d$: **1.09µg/kg/day**

$1b_4$) Excess Lifetime Cancer Risk
ELCR = ($LADDC_d + LADDA_d + LADDA_i + LADDC_i + LADD_{in}$)*CSF
= (0.76 µg/kg/day + 0.109 µg/kg/day + 0.76 µg/kg/day + 0.109 µg/kg/day + 2.54 µg/kg/day)*20-400 µg/kg/day = 4.28E-3 mg/kg/day*0.02–0.4 mg/**kg/day**
ELCR = 8.6E-5 to 1.7E-3

2) Assuming concentration is 78 ppb

2a) Noncancer Risk Child age 1–6 years

$2a_1$) Ingestion Dose age 1–6 years:

$LADD_c = IR_c$*[water]*ED* 1/BW*1/AT_{nc}
LADDc = 1 L/day*78 µg/L*6yr*1/16 kg*1/6 yr = **4.88 µg/kg/day or 4.88E-3 mg/kg/day**

$2a_2$) Inhalation Dose Child Age 1–6 years:
Shower/bath:
ADD_{ins} = [water]*C1*C2*I_{in}R*C3*C4*ED*1/BW*1/AT_{nc}
ADD_{ins} = (78 µg/L)*(0.1 µg/m^3/µg/L) *58*0.0083 m^3/min*15 min/event*1 event/day *6 years*1/16 kg*1/6yr = **3.52 µg/kg/day or 3.52E-3 mg/kg/day**

Household air:
ADD_{inh} = [water]*C1*I_{in}R*C4*C5*ED*1BW*1/AT_{nc}
ADD_{inh} = (78 µg/L*(0.1 µg/m^3/(µg/L))*0.0083 m^3/min*960 min/event*1 event/day*6 yr*1/16 kg*1/6 yr **= 3.88 µg/kg/day or 3.88 E-3 mg/kg/day**

Total Inhalation Dose Child
ADD_{in} = $ADDA_{ins}$ + $ADDA_{inh}$
= 3.52 µg/kg/day + 3.88 µg/kg/day
= **7.4 µg/kg/day or 7.4E-3 mg/kg/day**

$2a_3$) Dermal Dose Child:
The dermal dose is estimated to be the same as the ingestion dose**: 4.88 µg/kg/day***
ADD_d = **4.88 µg/kg/day**

$2a_4$) Noncancer Hazard Index Child
HI = ADD_d+ADD_i + ADD_{in}/Ref_d
HI = (4.88 µg/kg/day+4.88 µg/kg/day+ 7.4 µg/kg/day)/0.3 µg/kg/day = **57.2**

2b) Cancer Risks, child/adult age 1-30
$2b_1$) Ingestion Dose:
$LADD_c = IR_c$*[water]*ED* 1/BW*1/AT_c
$LADD_c$ = 1 L/day*78 µg/L*6 yr*1/16 kg*1/70 yr = **0.42 µg/kg/day or 4.18E-4 mg/kg/day**

$LADD_a = IR_a$*[water]*ED* 1/BW*1/AT_c
$LADD_a$ = 2 L/day*78 µg/L*20 yr*1/70 kg*1/70 yr = **0.637 µg/kg/day or 6.37E-4 mg/kg/day**

$2b_2$) Inhalation Dose
Showering/Bathing:

$LADDC_{ins}$ = [water]*C1*C2*I_{in}R*C3*C4*ED*1/BW*1/AT_c
$LADDC_{ins}$ = (78 µg/L*(0.1 µg/m^3/µg/L) *58*0.0083 m^3/min*15 min/event*1 event/day *6 years*1/16 kg*1/70 yr= **0.30 µg/kg/day or 3.02E-4 mg/kg/day**

$LADDA_{ins}$ = [water]*C1*C2*I_{in}R*C3*C4*ED*1/BW*1/AT_c
$LADDA_{in}$ = (78 µg/L*(0.1 µg/m^3/µg/L)*58*0.0139 m^3/min*15 min/event*1 event/day *20 years*1/70 kg*1/70 yr = **0.385 µg/kg/day or 3.85E-4 mg/kg/day**

Household Air:
$LADDC_{inh}$ = [water]*C1*I_{in}R*C4*C5*ED*1BW*1/AT_c
$LADDC_{inh}$ = 78 µg/L*(0.1 µg/m^3/(µg/L))*0.0083 m^3/min*960 min/event*1 event/day*6 yr*1/16kg*1/7 0yr = **0.33 µg/kg/day or 3.33E-4 mg/kg/day**

$LADDA_{inh}$ = [water]*C1*I_{in}R*C4*C5*ED*1BW*1/AT_c
$LADDA_{inh}$ = (78 µg/L*(0.1 µg/m^3/(µg/L))*0.0139 m^3/min*960 min/event*1 event/day*20 yr*1/70 kg*1/70 yr = **0.425 µg/kg/day or 4.25E-4 mg/kg/day**

Total Inhalation Dose
$LADD_{in}$= $LADDA_{ins}$ + $LADDA_{inh}$ + $LADDC_{ins}$ + $LADDC_{inh}$
0.30 µg/kg/day + 0.385 µg/kg/day + 0.33 µg/kg/day + 0.425 µg/kg/day
$LADD_{in}$= **1.44 µg/kg/day or 1.44E-3 µg/kg/day**

$2b_3$) Dermal:
Assume Dose is approximately equal to ingestion dose
$LADDC_d$: **0.42 µg/kg/day**
$LADDA_d$: **0.637 µg/kg/day**

$2b_4$) Excess Lifetime Cancer Risk
ELCR= ($LADDC_d$ + $LADDA_d$ + $LADDA_i$ + $LADDC_i$ +$LADD_{in}$)*CSF
= (0.42 µg/kg/day + 0.637 µg/kg/day + 0.42 µg/kg/day + 0.637 µg/kg/day + 1.44 µg/kg/day)*20–400 µg/kg/day
= 3.55E-3 mg/kg/day*0.02–0.4 mg/kg/day
ELCR = 7.1E-5 to 1.42E-3

Appendix I

Cheshire Community Needs Assessment Questionnaire

The Connecticut Department of Public Health (CT DPH), with assistance from the federal Agency for Toxic Substances and Disease Registry (ATSDR) is conducting a Public Health Assessment for Cheshire **(please see the attached fact sheet)**. Part of this work includes collecting and responding to concerns of Cheshire residents about reported environmental contamination in this community, and concerns about health effects such as cancer. This questionnaire has a number of purposes: 1) to gather these community concerns, 2) collect additional information about potential sources of hazardous waste contamination, and 3) to find out the best ways of communicating the results of our work to the public. **If you have any specific questions about this survey, please call Kenny Foscue at (860) 509-7742. If you have questions about the Community Advisory Panel (CAP) or the survey, contact Debra Bond, chairperson of the CAP at (203) 271-2384.**

Please take a few minutes to fill out this questionnaire and return it to the address at the end. Thank you very much for your time and assistance.

Name ____
(optional)

Address: ____
(optional)

____

Telephone: (home)_______________________(work)_______________________
(optional)

Email:____
(optional)

Do you currently live in Cheshire? _ Yes _ No How long have you lived in Cheshire? _____________

Do you have children who live with you? _Yes _No What are their ages? _________________

1. How would you like to receive public health information about the Cheshire Public Health Assessment process? (Check all that apply.)
   - ☐ Mail
   - ☐ Newspapers (which one(s)?) _________________________)
   - ☐ Community meeting
   - ☐ Cable/TV
   - ☐ Other _______________________________________

2. Would you be interested in learning more about…(check all that apply)?
   - ☐ chemicals that have been found at suspected sites in Cheshire?
   - ☐ chemicals in Cheshire's drinking water?
   - ☐ how people may come into contact with those chemicals?
   - ☐ how these chemicals can harm the body?
   - ☐ health outcomes such as cancer?

3. What are your main concerns about potential environmental health issues in Cheshire?
____

____

4. The Public Health Assessment process will include an evaluation of environmental data from several Cheshire waste sites. Are there waste or contaminated sites in Cheshire (or the immediate area) that you think we should evaluate? __ no __ yes If yes, please list them:
____

____

5. Cancer is a concern of some Cheshire residents. What specific questions about cancer would you like answered?
____

____

6. Are there any other environmental concerns or comments you would like to provide?
____

____

7. Do you feel that local, state and/or federal government agencies are responding appropriately to concerns about environmental health in Cheshire?

Local Agencies**:**

_Yes _ No Please explain:____

____

State Agencies:

_Yes _ No Please explain:____

____

Federal Agencies:

_Yes _ No Please explain____

____

8. The CT DPH can provide health care providers with information about the Public Health Assessment process and findings. Would you like your health provider to be added to our mailing list?

Physician Name: ____

Address: ____

____

Telephone: ____

Thank You!

Please complete, fold, staple and mail your completed survey by **July 15, 2003** to the address below:

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UNITEDSTATES

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Kenny Foscue, MPH
Toxic Hazards Assessment Section
Division of Environmental Epidemiology &
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CT Department of Public Health
PO Box 340308, MS # 11CHA
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Appendix J

Cheshire Community Needs Assessment Survey Results

Introduction

The Connecticut Department of Public Health (CT DPH), with assistance from the federal Agency for Toxic Substances and Disease Registry (ATSDR) conducted a Public Health Assessment for Cheshire. Part of this work included collecting and responding to concerns of Cheshire residents about reported environmental contamination in this community, and concerns about health effects such as cancer. This questionnaire had a number of goals: 1) to gather these community concerns, 2) collect additional information about potential sources of hazardous waste contamination, and 3) to find out the best ways of communicating the results of our work to the public. This report summarizes the findings of this survey.

Scheduled Release of PHA

The Public Health Assessment was released in April 2004.

Ongoing Activities

In addition to this Needs Assessment for the Public Health Assessment, a Health Assessor reviewed environmental data taken from the site and surrounding area.

Methods

Environmental Epidemiology and Occupational Health division staff of CT DPH, in consultation with ATSDR and the Cheshire Community Advisory Panel, developed the survey questionnaire collaboratively. The survey questionnaire was printed with a fact sheet describing the health assessment process. The questionnaire was then distributed as an insert in a local weekly newspaper, the *Cheshire Herald*. Approximately 8,000 copies were distributed. The questionnaires included return postage to increase response. Copies of the survey were also distributed and collected at three public places (Cheshire City Hall, library, and the senior center) in Cheshire. The collected surveys were then entered into a Microsoft Access database for analysis.

CT DPH and the Cheshire CAP held a Public Availability Session on June 24, 2003, to hand out the Needs Assessment Survey and Cheshire PHA Fact Sheet. CT DPH and the Cheshire CAP also held the session to answer questions about the Needs Assessment, the Cheshire PHA, and any community concerns. The fact sheet summarized the PHA process in Cheshire, including what data will be examined and community involvement activities. Representatives from the RWA and Chesprocott Health District were also present to answer questions from the community. One media interview was conducted with a CT DPH staff member. Thirteen residents attended the session.

Key Findings

See Tables 1–9 for a statistical description of the results.

1. The average length of residence in Cheshire for respondents is 19 years.
2. More than half of respondents are living with their children.
3. Most of the respondents would like to receive information about the Cheshire Public Health Assessment process by mail or in the newspaper.
4. The *Cheshire Herald* was the most subscribed newspaper.
5. Respondent's were interested in learning about:
   *Chemicals in Cheshire in drinking water
   *Chemicals that have been found at suspected sites in Cheshire
   *Health outcomes such as cancer
   *How these chemical can harm the human body
   *How many people have come into contact with those chemicals
6. Respondent's main concerns about potential environmental health issues in Cheshire were:
   *Public drinking water/chemicals in drinking water
   *General cancer concerns/incidence rates/cancer clusters
   *Private well drinking water/groundwater contamination
7. Approximately half the respondents thought that CT DPH should evaluate waste or contaminated sites in Cheshire.
8. A third of the respondents suggested that CT DPH evaluate all of the sites in Cheshire.
9. Cheshire Municipal Landfill was the site most commonly listed as a site that needed to be evaluated by CT DPH.
10. Of the cancer concerns in Cheshire, the respondents were mainly concerned with the following:
    - Cancer incidence rates/cancer clusters
    - Cancer and environmental pollution
    - Groundwater/ public water contamination causing cancer
    - Early onset of cancer among children
11. A higher percentage of respondents believed that the local government was responding more appropriately with environmental health concerns of Cheshire residents than the state or federal government. However, only about one third believed that the local government agency was responding appropriately to environmental health concerns.
12. Many of the respondents thought that the reasons for the local government agency not acting appropriately about environmental concerns were that it was low priority. They also thought that the local government agency should have taken a more active role and that not enough is being done.
13. Eighty-three respondents out of 267 (31%) would like the name of their healthcare provider to be on CT DPH's mailing list informing them about the Cheshire PHA process and its findings.

Discussion

A Public Health Assessment (PHA) focuses on identifying and evaluating any public health impacts from environmental hazards, (in this PHA, the public water supply, as well as 17 sites of concern in Cheshire) and provides information to the community about health risks and effects posed by contact with site contaminants. A PHA typically consists of three main components:

1. A review of available environmental data
2. A review of health outcome data, when applicable.
3. A compilation and response to community concerns.

This Needs Assessment is a tool used to gather information. Health Risk Assessors use the information gathered during a needs assessment to address a community's concerns, and to answer questions in the PHA document.

There was a return rate of 3% on this mail-in survey. The average length of residence of survey respondents is 19 years, which makes this sample reliable data. The majority of residents are currently living with their children. Most of the children were ten years old or younger (42%). About a third of the children were between the ages of 10 and 15 years old and a little less than a third were 15 years and younger.

Topics of Interest for Residents (Table 1)

Respondents were asked whether they were interested in learning more about certain environmental health topics in Cheshire. Almost all of the respondents were interested in learning more about the chemicals in the public drinking water. A large majority were also interested in learning more about chemicals found at sites of concern in Cheshire. In addition, respondents were interested in learning about health outcomes such as cancer, how chemicals in the public water supply and in the sites of concern can harm them and how many people may come into contact with those chemicals. The PHA will address all of these issues.

Residents' Main Concerns About Potential Environmental Issues in Cheshire (Table 2)

Respondents had several concerns about potential environmental issues in Cheshire. The most common ones were the public drinking water, cancer incidence rates and whether exposure to the contaminated water would result in an increase in cancer. Several were also concerned that their private wells were contaminated. A few respondents were concerned about high voltage lines, health and welfare of their families, air quality, and pesticides/lawn fertilizers. The PHA will address all of the main concerns about potential environmental issues in Cheshire. CT DPH will address many of the minor environmental concerns in Cheshire by handing out fact sheets at the next Public Availability Session to interested parties and to educate the Cheshire CAP on these issues if they are interested.

Suggested Waste Sites in Cheshire (Table 3)

About half of the respondents thought that there were sites of concern in Cheshire that should be evaluated by CT DPH. About a fourth of respondents did not think that there were sites that should be evaluated. CT DPH has evaluated 17 sites of concern in Cheshire in the Cheshire PHA.

About one-third of the respondents thought that all of the sites should be evaluated in Cheshire. The most common sites of concern listed were the Cheshire Municipal Landfill and Dalton Enterprises. Both are the sites are evaluated by CT DPH in the PHA.

Cancer Concerns (Table 4)

The top three specific questions about caner were cancer incidence rates and cancer clusters in Cheshire, cancer and environmental pollution, and public water supply contamination causing cancer (approximately 57% of respondents had questions about these topics). About 10% were concerned about early onset of cancer among children. The PHA specifically addressed cancer incidence rates in its health outcome section in adults and children. The implications section in the PHA addressed issues about cancer and public water supply contamination.

There were a few people concerned about cancer prevention and risk of cancer in Chapman School. There was a separate investigation about Chapman School and cancer rates by CT DPH which did not find elevated rates of cancer among employees at the school.

Other Environmental Concerns of Cheshire Residents (Table 5)

The top three environmental concerns listed as “other than the main environmental concerns” are groundwater/public water contamination, pesticides/lawn fertilizers, and types of cancer and associated risks of living in Cheshire. Contamination of the public water supply and cancer concerns have already been discussed as main environmental concerns. There was also concerns over air quality, power line expansions, chemical uses, and industrial accident potential. Many of these “other environmental concerns” have been mentioned and discussed as CAP meetings and in interviews with residents at the Cheshire PAS.

Response of Local, State, and Federal Government Agency in Dealing with Environmental Health Concerns of Cheshire Residents (Tables 6-8)

Respondents thought that the local government agency responded more appropriately in dealing with environmental health agencies than state or federal government agencies. However, only about one-third believed that the local government agency was responding appropriately. Many felt like it was a low priority amid budget cuts or that political pressure were reasons for the delays in response. Some also responded that the environmental laws were not strong enough. However, many expressed comments like, “At least something is being done now.”

Sources of Information

Most respondents would like to receive information about the PHA through the mail or through the newspaper. The most subscribed newspaper was the *Cheshire Herald*. Only a small percentage wanted the information presented at a community meeting (15%) or on television (14%). A few people (7%) wanted to receive the information via email.

CT DPH will distribute information about the PHA through the media and mass mailings with assistance of the Cheshire CAP. In addition, CT DPH will have a Public Availability Session when the PHA is released to give the Cheshire community an opportunity to get information first hand from CT DPH.

Summary of Community Concerns

The following are the main concerns expressed by the residents of Cheshire.

1. Residents are concerned that the contaminated drinking water in the past may have contributed to higher than expected levels of cancer, especially breast and childhood cancers.
2. Residents are concerned that the public water supply in Cheshire is currently contaminated.
3. Residents of Cheshire are concerned with 17 sites and whether they pose a health risk.
4. Residents are concerned about exposure to pollutants in the air from sites in Cheshire.

Table 1. Topics of interest

Interested in learning more about…	**% of respondents***
Chemicals in Cheshire drinking water?	92
Chemicals that have been found at suspected sites in Cheshire?	88
Health outcomes such as cancer?	79
How these chemicals can harm the body?	78
How many people may come into contact with those chemicals?	70

*Multiple answers. Total percentage exceeds 100.

Table 2. Main concerns about potential environmental health issues in Cheshire

Potential environmental health issue	**% of respondents***
Public drinking water/ Chemicals in drinking water/ TCE increase	32
Cancer general/ Cancer incidence rates/ Cancer clusters	28
Private well drinking water/ ground water contamination	24
Others	14
Non-specific pollution concerns/ high voltage lines	13
Health and welfare of my children and family members	12
Air quality	7
Pesticides/ lawn fertilizers	6
Unsure/ don’t know	3

*Multiple answers. Total percentage exceeds 100.

Table 3. Suggested waste or contaminated sites in Cheshire

Are there waste or contaminated sites you think we shall evaluate?	% of respondents
Yes	47
Did not answer	28
No	25
List of contaminated sites suggested	**% of respondents***
All the sites	31
Cheshire municipal landfill—Old site reported	16
Dalton—New site reported	9
Commercial growers using fertilizers and pesticides—New site reported	8
Ball and Socket Lagoon—Old site reported	4
Cheshire ground water contamination—Old site reported	4
Wells on Black Rock Road—New site reported	4
Others—Old sites reported	9
Others—New sites reported	27

*Multiple answers. Total percentage exceeds 100.

Table 4. Cancer concerns of Cheshire residents

Specific questions about cancer like to be answered	% of respondents*
Cancer incidence rates/ Cancer clusters	57
Cancer and environmental pollution	22
Ground water/ public water contamination causing cancer	12
Early onset of cancer among children	10
Risk of cancer in Chapman School	2
Cancer prevention/ protection	2
Other questions	2
No response/Unsure/ Don't know	5

*Multiple answers. Total percentage exceeds 100.

Table 5. Other environmental concerns of Cheshire residents

Other environmental concerns	% of respondents*
Ground water/ public water contamination	20
Pesticides/ lawn fertilizers	18
Types of cancer and associated risk of living in Cheshire	10
Power line expansions	8
Air quality	7
Industrial accident potential	7
Chemical uses	5
Zoning regulations	4
Developmental/sprawl	4
Route to truck pollution	3
Other environmental concerns	13
No response/Unsure/ Don't know	13

*Multiple answers. Total percentage exceeds 100.

Table 6. Response of local governmental agency in dealing with environmental health concerns of Cheshire residents

Do you feel that local governmental agency is responding appropriately?	% of respondents
Yes	35
Did not answer	25
No	40
Reasons for responding/ not responding appropriately	**% of respondents**
Yes—At least something is being done now/After being pressured to/ Currently responding to concerns of residents/ Conducted a study at Chapman School when requested.	23
No—Not doing anything/Should have taken more active role/ Not enough is being done.	41
No—Did not address properly about higher incidence of cancer in Cheshire	10
No—Unsafe public/well drinking water/TCE in drinking water	8
No—No remediation of contaminated sites/ Environmental pollution	8
No—Other environmental health concerns	10

Table 7: Response of state governmental agency in dealing with environmental health concerns of Cheshire residents

Do you feel that state governmental agency is responding appropriately?	% of respondents
Yes	27
Did not answer	30
No	43
Reasons for responding/ not responding appropriately	**% of respondents***
Yes—Recently conducted Public Health Need Assessment Survey	13
Yes—At least something is being done now/After being pressured to/ Taking citizens concerns seriously/ Conducted a study at Chapman School when requested.	10
Yes—Other environmental health concerns	9
No—Not doing anything/Low priority amid budget cuts/Political pressure	42
No—No remediation of contaminated sites/ Environmental pollution	13
No—Did not address properly about higher incidence of cancer in Cheshire	9
No—Unsafe public/well drinking water/TCE in drinking water	5

Table 8. Response of federal governmental agency in dealing with environmental health concerns of Cheshire residents

Do you feel that federal governmental agency is responding appropriately?	% of respondents
Yes	20
Did not answer	32
No	48
Reasons for responding/ not responding appropriately	**% of respondents**
Yes—At least something is being done now/After being pressured to/ Taking citizen's concerns seriously	8
Yes—Ongoing studies/ Assessment of the environmental health problems	8
No—No action/ Political pressure/ Laws are not strong enough	50
No—No remediation of contaminated sites/ Environmental pollution/ Air Quality	21
No—Did not address properly about higher incidence of cancer in Cheshire	8
No—Unsafe public/well drinking water/TCE in drinking water	5

Table 9. Inclusion of name of the Health Care Provider in the mailing list informing about Public Health Assessment Process and its findings

Would you like name of your health care provider on our mailing list?	% of respondents
Yes	31
Did not answer	61
No	8

Appendix K

Comments and Responses Concerning This Public Health Assessment

Comment #1: Please explain how the prison population in Cheshire was factored into cancer statistics.

Response #1: Cancers diagnosed in prisoners in Cheshire are reported to the Connecticut Tumor Registry (CTR) and counted for the town of Cheshire if the prisoner's home address is in Cheshire. If no home address is available for a prisoner diagnosed with cancer, the address of the correctional facility (Cheshire) would be used and the cancer would be included in the CTR for the town of Cheshire. A prisoner in Cheshire who is diagnosed with cancer and has a home address not in Cheshire would not be included in the cancer cases for Cheshire. Population estimates for the town of Cheshire include the prison population.

Comment #2: Given the non-specific trend in childhood cancers noted in this report, I believe the incidence analysis should be repeated once data beyond 2000 is available.

Response #2: CT DPH agrees. Because of the non-specific trend in childhood cancers, CT DPH will analyze childhood cancer rates for the years 2001–2006 when they become available.

Comment #3: I know of about 11 people of out 50 with cancer in Cheshire and I wonder if this is normal.

Response #3: Yes, it does appear normal. Background rates of cancer in the United States are about 1 in 2 or 3. This means that in a group of 50 people, approximately 17 to 25 would be diagnosed with cancer. Therefore, 11 people with cancer in a group of 50 does not appear to be an elevated cancer rate.

Comment #4: Do the barite mines pose a health hazard? I am concerned about radon contamination in my home and barium and copper contamination in the public water supply.

Response #4: The barite mines in Cheshire may pose a safety hazard for the homes that are directly above them. There have been reports of "sink holes" in backyards of these homes. Sink holes can present a safety hazard. With respect to barium and copper contamination in the public water supply, the RWA routinely tests the public water supply for barium and copper and these metals have not contaminated the water supply. CT DPH believes that it is very unlikely that radon would accumulate in the barite mines at high enough levels to pose a health hazard inside homes located directly above the mines. Nevertheless, testing your home for radon is always a good idea. Radon tests are easy and inexpensive and are the only way to know for sure whether you and your family are at risk from radon exposure in your home. Radon test kits can be purchased at any local hardware or home improvement store.

Comment #5: Given the statistically increased frequency of breast cancer in the last time period, the report should include information on what xenoestrogens have been studied and what levels exist in water and soil.

Response #5: Xenoestrogens are man-made chemicals that mimic the effect of estrogen in the body. They are found in many common products such as cosmetics, detergents, plastics and pesticides. Based on CT DPH's review of sampling data from the public water supply and the 17 sites of concern, there is no evidence that xenoestrogenic compounds are a concern. However, since xenoestrogens are present in many common household products, individuals may be receiving exposures from their own use of these products.

Comments #6: Total number of pediatric cancer cases seems small in each 5-year time period. Can these be reconciled with a Cheshire resident's counts?

Response #6: CT DPH received information from a Cheshire resident about 12 cancer cases among children less than 19 years. The Connecticut Tumor Registry (CTR) reported 11 cancers for the period 1995–1999. There are a several reasons why the number of cancer cases in the CTR may differ from the number counted by the Cheshire resident. The CTR only includes cancers diagnosed in residents of Connecticut. In addition, not all "cancers" are reportable to the CTR. Certain benign tumors and some skin cancers such as basal cell and squamous cancers are not reported in the CTR. The difference between the number of cancers counted by the Cheshire resident and the number reported in the CTR is small and would not change the conclusions of the analysis.

Comment #7: Is pancreatic cancer related to TCE exposure?

Response #7: There is an epidemiological study among dry cleaning workers that resulted in a statistically significant increased risk of pancreatic cancers. Studies also suggest that there may be an increased risk of pancreatic cancer among diabetics exposed to TCE. However, in animal experimental studies, the link between pancreatic cancer and TCE exposure has not been well established to date (EPA 2001). More overall studies are necessary to establish a relationship between TCE exposure and pancreatic cancer.

Comment #8: There should be information on the results of testing of other environmental toxins in the Cheshire water supply and soil. For instance, the PHA should include an appendix with the results of all other EPA regulated toxins and how these results compare to MCLs.

Response #8: The RWA routinely tests the public water supply for hundreds of contaminants. Listing all the sample results would amount to several hundred pages. Likewise, including results of all chemicals tested for in soil at industrial sites would amount to hundreds of pages. Rather than include all sample results, CT DPH included (or discussed) data only when contaminant levels exceeded regulatory standards.

Comment #9: Please provide breast cancer analysis using referent group adjusted for socio-economic variables. Is the magnitude of the SIR different or is it the confidence interval? Is it possible to repeat this analysis for other cancer types?

Response #10: As described in the Public Health Assessment, socioeconomic variables were considered in a previously completed evaluation of breast cancer rates in Connecticut towns

(Polednak 2003). When socioeconomic variables were considered in the previously completed evaluation, the expected number of breast cancer cases increased in Cheshire because Cheshire residents are more affluent than average Connecticut residents. The increase in the number of expected breast cancers caused the observed incidence in Cheshire to no longer be statistically significant. This does not mean that the observed increase in breast cancer is not real, but rather provides one explanation as to why the increase was observed. It is possible to include socioeconomic variables in evaluating other cancer types. However, CT DPH chose not to perform these additional analyses because none of the other cancer types evaluated in this Public Health Assessment have elevations that were statistically significant or have socioeconomic status as a strong risk factor.

Comment #11: The pediatric cancer SIRs suggest a trend with each time period. Wide confidence bands may be due to small numbers. Can ATSDR/CTDPH comment?

Response #11: The size of the confidence interval for a SIR depends on the number of cancer cases. When there are only a few cases, the confidence interval will be larger than when there are more cancer cases. A wide confidence interval indicates that the SIR is not very precise. A confidence interval that includes the value one means that there is greater than a 5% chance that the difference between observed and expected cancer cases is due to random variation in cancer cases. The confidence intervals for pediatric cancer SIRs for each time period are wide and include the value one.

Comment #12: Can ATSDR/CTDPH provide a written statement that SIRs of 5 or greater constitute a "signal"?

Response #12: The PHA does not mention an SIR of 5 or greater as an important finding. An SIR of 5 or greater was discussed as a point of reference at a Cheshire CAP meeting. An SIR of 5 means that there is a 500% increase in observed cancers versus expected cancers. In general, a SIR of 5 or larger (with statistical significance) would indicate the need for careful further investigation. However, an SIR of 5 is not a firm, established action level or standard but rather a general point of comparison for further investigation. CT DPH has found that an SIR of 5 or greater has been used in other states as a general indicator of the need for further study. Depending on the specific circumstances, SIRs less than 5 may also warrant further investigation.

Comment #13: Can the PHA (and DPH press release) state that there is little or no historical exposure data available on private wells? Can DPH or RWA comment on the procedures used to test private wells adjacent to sites of concern?

Response #13: The PHA includes a discussion of the lack of data regarding TCE levels in three private wells near two of the sites of concern (Alling Lander and County Wide Construction). In general, it is the homeowners responsibility to test their own private well water. However, if a source of groundwater contamination is being investigated (either by an environmental agency such as DEP, or by an industrial company responsible for polluting the groundwater), it is likely that nearby private wells will be tested as part of the investigation (at no cost to the homeowner).

Comment #14: Did the Health Outcome Data Evaluation focus on all cases of pediatric cancers *(including sarcomas, neuroblastomas, Wilms' Tumor, etc)?*

Response #14: Yes, all cases of pediatric cancers were included.

Comment #15: The discussion of childhood cancers indicates the types of cancers reported. Several of the types of cancer listed for boys during the 1995–2000 period are notable since they are more often associated with adults: colon, oral, melanoma. More information would be useful to understand why these tumors occurred in this age group. For example, what other risk factors may have been at play?

Response #15: According to the Connecticut Tumor Registry, these cancers do sporadically occur in children. It is likely that most if not all of these reported cancers occurred in children at the older end of the 19-year age bracket (age 0–19 years). However, the numbers of cases are too small to allow a more detailed analysis of cancers within this age bracket. Genetic influences are most likely the strongest risk factors for these cancers.

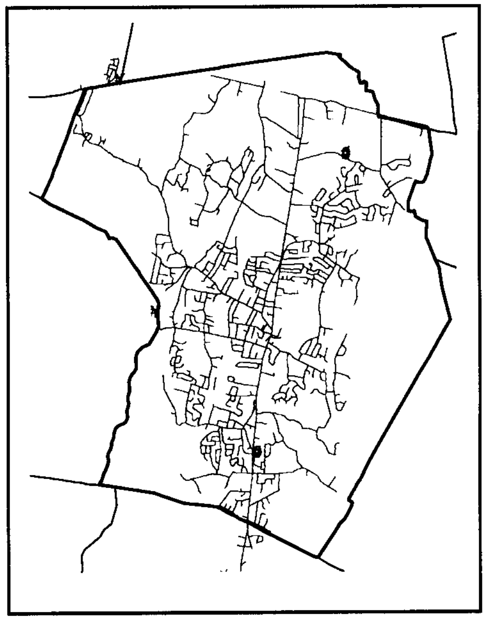
Appendix L

Fact Sheet

EVALUATION OF COMMUNITY CONCERNS IN CHESHIRE, CT

BACKGROUND

Cheshire, Connecticut Wellfields



Some Cheshire citizens have expressed concerns about reported contamination in their community and whether such contamination may be related to health effects such as cancer. The Connecticut Department of Public Health (CT DPH), with assistance from the federal Agency for Toxic Substances and Disease Registry (ATSDR) has conducted a Public Health Assessment for Cheshire. ATSDR is a federal public health agency and has a cooperative agreement with CT DPH. A Public Health Assessment is a process that reviews available information about hazardous substances and evaluates whether exposure to them can cause any harm to people. A Public Health Assessment is not the same thing as a medical examination or community health survey. In conducting a Public Health Assessment (PHA), three main sources of information were reviewed: **Environmental data**, such as water sampling data, **Health data**, including available information about rates of diseases in the community compared to state rates, and **Community concerns.** These concerns were obtained by working with the Cheshire Advisory Panel, a community concerns survey, an open house in June 2003 and meetings. This fact sheet summarizes the findings of the Cheshire Community Concerns PHA. If you would like a copy of the PHA, please call (860) 509-7742, or go to the web site provided on the last page.

HOW DO WE EVALUATE HEALTH RISKS?

It is important to understand how CTDPH evaluates exposures and how we make **decisions about health risks** for hazardous waste sites. The first step is to find out if there has been exposure to contaminants. Then we try to find out how long people were exposed and to how much contamination. We then estimate cancer and other health risks. Finally, we come to a conclusion about whether the exposure is likely to cause illness. If we conclude that exposures may have caused disease, we may recommend further studies. Here are some concepts important in evaluating health risks to contaminants:

- **"Exposure"** means that you have come into contact (breathing, eating, touching) with a chemical and it has gotten into your body.
- If you are **not exposed** to a chemical, **it won't make you sick.**
- CTDPH is required to use accepted science-based methods when we evaluate health risks. When CTDPH analyzes environmental data, we use conservative (most protective of health) health guide-

lines and approaches to reach our conclusions and make our recommendations.

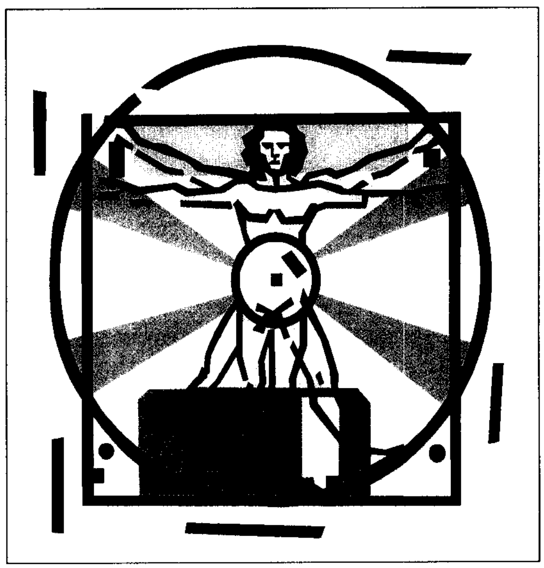
- It is very difficult to determine if people have gotten sick from a site, even though it may be shown that people were likely exposed. This is because of many complicated factors:
  - ⇒ Were people exposed long enough and to enough of the contaminant?
  - ⇒ What are other exposures?
  - ⇒ What are some lifestyle issues, such as diet, smoking, etc?

Just because we may not be able to say that people have gotten sick from contaminants, this does not mean the community should not be concerned or work to clean up environmental contamination. Preventing exposures is very important!

UNDERSTANDING CANCER RISK EVALUATION:

Background:

Cancer is the uncontrolled growth and spread of abnormal cells anywhere in the body. However, cancer is not just one disease; it is actually an umbrella term for at least 100 different but related diseases. Studies have shown that different cancer types have different causes, patterns of incidence, risk factors, and latency periods (periods between exposure and development of disease). Here are some basic facts about cancer:



- Each type of cancer has known and/or suspected risk factors.
- Cancer is almost always caused by a combination of factors that interact like diet, genetics, exposures, etc.
- One difficulty in looking at cancer and environmental contamination is the long latency period. This the long period of time between exposure to a carcinogen and development of cancer. Most cancers have a latency period of 10 years or more.
- Cancer is more likely to occur as people get older; more cases of cancer can be expected in the future because people are living longer.

Evaluating Cancer in the Public Health Assessment

Cancer rates were evaluated for the town of Cheshire for the period 1975 - 2000. Seven cancer types were evaluated, as well as overall childhood cancer. The rate of cancer in Cheshire was then compared to the rate of that disease for the entire state of Connecticut. This was done to determine if the rate seen in Cheshire was unusual. The analysis was conducted for males and females separately and was conducted for three separate time periods (1975 - 1984, 1985 - 1994, and 1995-2000). Data for this analysis was obtained from the Connecticut Tumor Registry. This Registry is the oldest and one the best tumor registries in the country. This Registry provides a comprehensive listing of people who have been diagnosed with cancer.

WHAT SITES WERE EVALUATED?

Public Water Supply:

Environmental assessments in Cheshire have focused on past contamination of the public water supply. It is known that the town's public water supply was contaminated with volatile organic compounds (VOCs) from the late 1970s through the late 1980s. Aeration towers were installed which reduced the VOC levels in the drinking water to below the drinking water standards. The VOCs found in the public water supply that were above drinking water standards were trichloroethylene (TCE) and 1,2-dichloropropane (DCP).

Other Sites:

Environmental data from 17 sites of concern in the Cheshire community were also evaluated for their overall impact on the residents of the Cheshire community. On-site soil and groundwater contamination is or was present in the 17 sites at some point. Available environmental sampling data from a very small number of private wells near the sites below were also reviewed. The following sites were evaluated:

Airpax Corporation	Knotter Drive
Alling Lander Company	300 East Johnson Avenue
Ball and Socket Lagoon	Willow Street
Ball and Socket Manufacturing	Willow Street
Bovano's	830 S. Main Street
Carbide Mold	349 Industrial Avenue
Cheshire Associates	604 W. Johnson Avenue
Cheshire Municipal Landfill	Waterbury Road
County Wide Construction	340 E. Johnson Avenue
Holgrath Corporation	30 Knotter Drive
Olin Corporation Chemical Group	359 Knotter Drive
Oslo Control	328 Industrial Avenue
Peerless Screw	286 Sandbank Road
Suburban Excavators	1074 S. Main Street
Superior Steel Products	Peck Lane
TRW-Dot Fastener Division	250 Knotter Drive
US Chemical Corporation	264 Sandbank Road
Dalton Enterprises	493 W. Main St.

GLOSSARY:

Cancer rate: The number of new cases of cancer divided by the population. Rates are usually expressed as number of cases per 1,000, 10,000 or 100,000 persons. Rates allow the comparison of cancer incidence in populations that are of different sizes.

Cancer Risk: A theoretical risk for getting cancer if exposed to a substance every day for 70 years (a lifetime exposure). The true risk might be lower.

Epidemiology: The study of the distribution and factors that affect the distribution of disease in the population.

Latency Period: The time between exposure and the development of disease.

Public Health Action: A list of steps to protect public health.

Population-based studies: Epidemiology studies that include a group rather than individuals in the analysis.

Non-Hodgkin's Lymphoma: Cancer in the lymphatic system. Likely to spread more quickly and respond less well to treatment than Hodgkin's disease. Non-Hodgkin's lymphoma incidence increases with increasing age. It also has been increasing in incidence during the past few decades.

Risk Factors: Traits, exposures or habits that may influence the development of disease. For example, a person who has the risk factor of smoking has an increased risk of developing emphysema.

Site of Diagnosis: The place in the body where the cancer is found (e.g. breast, lung, colon).

Statistically significant: When the results are unlikely to be due to random chance.

VOCs: Contaminants that can easily evaporate. Gasoline and other solvents are VOCs.

WHAT DID WE FIND? WHAT WERE THE CONCLUSIONS?

Environmental Data Findings:

- Levels of TCE in the public water supply exceeded drinking water standards from at least 1979 till 1988. Also, some level of contamination may have been present for an unknown period prior to 1979. Levels of DCP in the public water supply exceeded drinking water standards from at least 1983 until 1986.

- Some Cheshire residents were likely exposed to contaminants in the public water supply in the past through direct contact with the contaminated water (ingestion, skin contact, inhaling contaminated indoor air). Because the level of VOC contamination after 1988 was below drinking water standards, Cheshire residents who drank the water after this date were not exposed to the contaminants at levels of health concern.

- There were at least three private wells near Alling Lander/County Wide Construction where TCE levels were contaminated with elevated levels of TCE. These homes were put on a bottled water program after the discovery of the contamination and then transferred to public water in 1990. We did not document a widespread problem of private well contamination but data on this issue are very limited.

- Even though CT DPH has concluded that health effects are not likely to have occurred from the contaminated water supply, it necessary for the RWA to have taken action necessary to reduce contaminant levels in the public water supply because TCE and DCP levels exceeded health-based guidelines that were in effect at that time. The RWA's actions were successful in drastically reducing future exposures to contaminants in the water supply.

What Public Health Actions Have Already Happened?

Actions Taken

→ CT DPH has assisted the community in forming a Community Advisory Panel (CAP) made up of town leaders and concerned citizens to assist and advise CT DPH on the concerns of the residents, as well as serve as liaison between the public and CT DPH.

→ CT DPH has met routinely with the Cheshire Community Advisory Panel, the CT Department of Environmental Protection, the Southern Connecticut Regional Water Authority (RWA), and Chesprocott Health District to discuss the PHA and try to come up with a resolution to many of these issues. CT DPH has also educated community leaders on environmental issues in Cheshire and methods in order to resolve many of these issues.

→ CT DPH held an Open House in Cheshire on June 24, 2003 to hand out information and educate the residents about the Cheshire PHA process and information on environmental issues.

Actions Planned

→ CT DPH will continue to provide education to the residents about environmental issues in the town of Cheshire. When this PHA is released, a revised version of this fact sheet concerning the results of the Cheshire PHA will be also distributed to community members.

→ CT DPH will continue to work closely with the Cheshire CAP, CT DEP, RWA, and town leaders, as well as the Chesprocott Health District to ensure that the environmental concerns of residents are met.

What Does CTDPH Recommend?

- CT DPH and the Chesprocott Health Department should continue to work with the community leaders to educate them about specific environmental issues like pesticide use, private well issues, etc., in the town of Cheshire in order to avoid unnecessary exposures.

- CT DPH, CT DPH (Water Division), and the RWA should continue to work together to ensure that the public water supply is safe. The RWA should continue to monitor the water supply for contaminants, especially VOCs.

- CT DEP, RWA, CT DPH (Water Division), and the EPA should continue to monitor the remaining 12 CERCLIS sites to ensure that any groundwater contamination immediately beneath the site is not leaching into any nearby private wells. In addition, if there are any sites with contaminated soil that are accessible to the public, these areas need to be fenced in. In the case of Alling Lander, the building on the property is currently easily accessible and should be boarded up and secured.

- CT DEP (Air Division) should continue to monitor the odors from Dalton Enterprises and make sure that they do not violate any regulations. Dalton Enterprises has had numerous complaints from nearby residents, but was never cited.

- CT DPH recommends that further evaluation of the Alling Lander, County Wide Construction, and Cheshire Municipal Landfill sites be undertaken to help determine if remediation is necessary.

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ATSDR Glossary of Environmental Health Terms

The Agency for Toxic Substances and Disease Registry (ATSDR) is a federal public health agency with headquarters in Atlanta, Georgia, and 10 regional offices in the United States. ATSDR's mission is to serve the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and diseases related to toxic substances. ATSDR is not a regulatory agency, unlike the U.S. Environmental Protection Agency (EPA), which is the federal agency that develops and enforces environmental laws to protect the environment and human health.

This glossary defines words used by ATSDR in communications with the public. It is not a complete dictionary of environmental health terms. If you have questions or comments, call ATSDR's toll-free telephone number, 1-888-42-ATSDR (1-888-422-8737).

Absorption
The process of taking in. For a person or animal, absorption is the process of a substance getting into the body through the eyes, skin, stomach, intestines, or lungs.

Acute
Occurring over a short time [compare with **chronic**].

Acute exposure
Contact with a substance that occurs once or for only a short time (up to 14 days) [compare with **intermediate duration exposure** and **chronic exposure]**.

Adverse health effect
A change in body function or cell structure that might lead to disease or health problems.

Background level
An average or expected amount of a substance or radioactive material in a specific environment, or typical amounts of substances that occur naturally in an environment.

CAP
See **Community Assistance Panel**.

Cancer
Any one of a group of diseases that occurs when cells in the body become abnormal and grow or multiply out of control.

Cancer risk
A theoretical risk for getting cancer if exposed to a substance every day for 70 years (a lifetime exposure). The true risk might be lower.

Carcinogen
A substance that causes cancer.

Case study
A medical or epidemiologic evaluation of one person or a small group of people to gather information about specific health conditions and past exposures.

Case-control study
A study that compares exposures of people who have a disease or condition (cases) with people who do not have the disease or condition (controls). Exposures that are more common among the cases may be considered as possible risk factors for the disease.

Central nervous system
The part of the nervous system that consists of the brain and the spinal cord.

CERCLA [see **Comprehensive Environmental Response, Compensation, and Liability Act of 1980**]

Chronic
Occurring over a long time (more than 1 year) [compare with **acute**].

Chronic exposure
Contact with a substance that occurs over a long time (more than 1 year) [compare with **acute exposure** and **intermediate duration exposure**].

Cluster investigation
A review of an unusual number, real or perceived, of health events (for example, reports of cancer) grouped together in time and location. Cluster investigations are designed to confirm case reports; determine whether they represent an unusual disease occurrence; and, if possible, explore possible causes and contributing environmental factors.

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

Comparison value (CV)
Calculated concentration of a substance in air, water, food, or soil that is unlikely to cause harmful (adverse) health effects in exposed people. The CV is used as a screening level during the public health assessment process. Substances found in amounts greater than their CVs might be selected for further evaluation in the public health assessment process.

Completed exposure pathway [see **exposure pathway**].

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)
CERCLA, also known as **Superfund**, is the federal law that concerns the removal or cleanup of hazardous substances in the environment and at hazardous waste sites. ATSDR, which was created by CERCLA, is responsible for assessing health issues and supporting public health activities related to hazardous waste sites or other environmental releases of hazardous substances.

Concentration
The amount of a substance present in a certain amount of soil, water, air, food, blood, hair, urine, breath, or any other media.

Contaminant
A substance that is either present in an environment where it does not belong or is present at levels that might cause harmful (adverse) health effects.

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

Dermal
Referring to the skin. For example, dermal absorption means passing through the skin.

Dermal contact
Contact with (touching) the skin [see **route of exposure**].

Descriptive epidemiology
The study of the amount and distribution of a disease in a specified population by person, place, and time.

Detection limit
The lowest concentration of a chemical that can reliably be distinguished from a zero concentration.

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

Dose (for chemicals that are not radioactive)
The amount of a substance to which a person is exposed over some time period. Dose is a measurement of exposure. Dose is often expressed as milligram (amount) per kilogram (a measure of body weight) per day (a measure of time) when people eat or drink contaminated water, food, or soil. In general, the greater the dose, the greater the likelihood of an effect. An “exposure dose” is how much of a substance is encountered in the environment. An “absorbed dose” is the amount of a substance that actually got into the body through the eyes, skin, stomach, intestines, or lungs.

Dose-response relationship
The relationship between the amount of exposure [**dose**] to a substance and the resulting changes in body function or health (response).

Environmental media
Soil, water, air, **biota** (plants and animals), or any other parts of the environment that can contain contaminants.

Environmental media and transport mechanism
Environmental media include water, air, soil, and **biota** (plants and animals). Transport mechanisms move contaminants from the source to points where human exposure can occur. The **environmental media and transport mechanism** is the second part of an **exposure pathway**.

EPA
United States Environmental Protection Agency.

Epidemiologic surveillance
The ongoing, systematic collection, analysis, and interpretation of health data. This activity also involves timely dissemination of the data and use for public health programs.

Epidemiology
The study of the distribution and determinants of disease or health status in a population; the study of the occurrence and causes of health effects in humans.

Exposure
Contact with a substance by swallowing, breathing, or touching the skin or eyes. Exposure may be short-term [**acute exposure**], of intermediate duration, or long-term [**chronic exposure**].

Exposure assessment
The process of finding out how people come into contact with a hazardous substance, how often and for how long they are in contact with the substance, and how much of the substance they are in contact with.

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

Exposure pathway
The route a substance takes from its source (where it began) to its end point (where it ends), and how people can come into contact with (or get exposed to) it. An exposure pathway has five parts: a **source of contamination** (such as an abandoned business); an **environmental media and transport mechanism** (such as movement through groundwater); a **point of exposure** (such as a private well); a **route of exposure** (eating, drinking, breathing, or touching); and a **receptor population** (people potentially or actually exposed). When all five parts are present, the exposure pathway is termed a **completed exposure pathway**.

Exposure registry
A system of ongoing followup of people who have had documented environmental exposures.

Feasibility study
A study by EPA to determine the best way to clean up environmental contamination. A number of factors are considered, including health risk, costs, and what methods will work well.

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

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

Hazardous Substance Release and Health Effects Database (HazDat)
The scientific and administrative database system developed by ATSDR to manage data collection, retrieval, and analysis of site-specific information on hazardous substances, community health concerns, and public health activities.

Hazardous waste
Potentially harmful substances that have been released or discarded into the environment.

Health consultation
A review of available information or collection of new data to respond to a specific health question or request for information about a potential environmental hazard. Health consultations are focused on a specific exposure issue. Health consultations are therefore more limited than a public health assessment, which reviews the exposure potential of each pathway and chemical [compare with **public health assessment**].

Health education
Programs designed with a community to help it know about health risks and how to reduce these risks.

Health investigation
The collection and evaluation of information about the health of community residents. This information is used to describe or count the occurrence of a disease, symptom, or clinical measure and to estimate the possible association between the occurrence and exposure to hazardous substances.

Health promotion
The process of enabling people to increase control over, and to improve, their health.

Health statistics review
The analysis of existing health information (i.e., from death certificates, birth defects registries, and cancer registries) to determine if there is excess disease in a specific population, geographic area, and time period. A health statistics review is a descriptive epidemiologic study.

Indeterminate public health hazard
The category used in ATSDR's public health assessment documents when a professional judgment about the level of health hazard cannot be made because information critical to such a decision is lacking.

Incidence
The number of new cases of disease in a defined population over a specific time period [contrast with **prevalence**].

Ingestion
The act of swallowing something through eating, drinking, or mouthing objects. A hazardous substance can enter the body this way [see **route of exposure**].

Inhalation
The act of breathing. A hazardous substance can enter the body this way [see **route of exposure**].

Intermediate duration exposure
Contact with a substance that occurs for more than 14 days and less than a year [compare with **acute exposure** and **chronic exposure**].

Lowest-observed-adverse-effect level (LOAEL)
The lowest tested dose of a substance that has been reported to cause harmful (adverse) health effects in people or animals.

Metabolism
The conversion or breakdown of a substance from one form to another by a living organism.

Metabolite
Any product of **metabolism**.

mg/kg
Milligram per kilogram.

mg/cm^2
Milligram per square centimeter (of a surface).

mg/m^3
Milligram per cubic meter; a measure of the concentration of a chemical in a known volume (a cubic meter) of air, soil, or water.

Minimal risk level (MRL)
An ATSDR estimate of daily human exposure to a hazardous substance at or below which that substance is unlikely to pose a measurable risk of harmful (adverse), noncancerous effects. MRLs

are calculated for a route of exposure (inhalation or oral) over a specified time period (acute, intermediate, or chronic). MRLs should not be used as predictors of harmful (adverse) health effects [see **reference dose**].

National Priorities List for Uncontrolled Hazardous Waste Sites
(National Priorities List or **NPL)**
EPA's list of the most serious uncontrolled or abandoned hazardous waste sites in the United States. The NPL is updated on a regular basis.

No apparent public health hazard
A category used in ATSDR's public health assessments for sites where human exposure to contaminated media might be occurring, might have occurred in the past, or might occur in the future, but where the exposure is not expected to cause any harmful health effects.

No-observed-adverse-effect level (NOAEL)
The highest tested dose of a substance that has been reported to have no harmful (adverse) health effects on people or animals.

No public health hazard
A category used in ATSDR's public health assessment documents for sites where people have never and will never come into contact with harmful amounts of site-related substances.

NPL [see **National Priorities List for Uncontrolled Hazardous Waste Sites]**

Pica
A craving to eat nonfood items, such as dirt, paint chips, and clay. Some children exhibit pica-related behavior.

Plume
A volume of a substance that moves from its source to places farther away from the source. Plumes can be described by the volume of air or water they occupy and the direction they move. For example, a plume can be a column of smoke from a chimney or a substance moving with groundwater.

Point of exposure
The place where someone can come into contact with a substance present in the environment [see **exposure pathway**].

Population
A group or number of people living within a specified area or sharing similar characteristics (such as occupation or age).

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

ppb
Parts per billion.

ppm
Parts per million.

Prevalence
The number of existing disease cases in a defined population during a specific time period [contrast with **incidence**].

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

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

Public comment period
An opportunity for the public to comment on agency findings or proposed activities contained in draft reports or documents. The public comment period is a limited time period during which comments will be accepted.

Public availability session
An informal, drop-by meeting at which community members can meet one-on-one with ATSDR staff members to discuss health and site-related concerns.

Public health action
A list of steps to protect public health.

Public health advisory
A statement made by ATSDR to EPA or a state regulatory agency that a release of hazardous substances poses an immediate threat to human health. The advisory includes recommended measures to reduce exposure and reduce the threat to human health.

Public health assessment (PHA)
An ATSDR document that examines hazardous substances, health outcomes, and community concerns at a hazardous waste site to determine whether people could be harmed from coming into contact with those substances. The PHA also lists actions that need to be taken to protect public health [compare with **health consultation**].

Public health hazard
A category used in ATSDR's public health assessments for sites that pose a public health hazard because of long-term exposures (greater than 1 year) to sufficiently high levels of hazardous substances or **radionuclides** that could result in harmful health effects.

Public health hazard categories
Public health hazard categories are statements about whether people could be harmed by conditions present at the site in the past, present, or future. One or more hazard categories might be appropriate for each site. The five public health hazard categories are **no public health hazard**, **no apparent public health hazard**, **indeterminate public health hazard**, **public health hazard**, and **urgent public health hazard**.

Public health statement
The first chapter of an ATSDR **toxicological profile**. The public health statement is a summary written in words that are easy to understand. The public health statement explains how people might be exposed to a specific substance and describes the known health effects of that substance.

Public meeting
A public forum with community members for communication about a site.

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

Reference dose (RfD)
An EPA estimate, with uncertainty or safety factors built in, of the daily lifetime dose of a substance that is unlikely to cause harm in humans.

Registry
A systematic collection of information on persons exposed to a specific substance or having specific diseases [see **exposure registry** and **disease registry**].

Remedial investigation
The CERCLA process of determining the type and extent of hazardous material contamination at a site.

Resource Conservation and Recovery Act (1976, 1984) (RCRA)
This Act regulates management and disposal of hazardous wastes currently generated, treated, stored, disposed of, or distributed.

RfD
See **reference dose**.

Risk
The probability that something will cause injury or harm.

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

Risk communication
The exchange of information to increase understanding of health risks.

Route of exposure
The way people come into contact with a hazardous substance. Three routes of exposure are breathing [**inhalation**], eating or drinking [**ingestion**], or contact with the skin [**dermal contact**].
SARA [see **Superfund Amendments and Reauthorization Act**]

Sample
A portion or piece of a whole. A selected subset of a population or subset of whatever is being studied. For example, in a study of people the sample is a number of people chosen from a larger population [see **population**]. An environmental sample (for example, a small amount of soil or water) might be collected to measure contamination in the environment at a specific location.

Sample size
The number of units chosen from a population or environment.

Solvent
A liquid capable of dissolving or dispersing another substance (for example, acetone or mineral spirits).

Source of contamination
The place where a hazardous substance comes from, such as a landfill, waste pond, incinerator, storage tank, or drum. A source of contamination is the first part of an **exposure pathway**.

Special populations
People who might be more sensitive or susceptible to exposure to hazardous substances because of factors such as age, occupation, sex, or behaviors (for example, cigarette smoking). Children, pregnant women, and older people are often considered special populations.

Statistics
A branch of mathematics that deals with collecting, reviewing, summarizing, and interpreting data or information. Statistics are used to determine whether differences between study groups are meaningful.

Substance
A chemical.

Substance-specific applied research
A program of research designed to fill important data needs for specific hazardous substances identified in ATSDR's **toxicological profiles**. Filling these data needs would allow more accurate assessment of human risks from specific substances contaminating the environment. This research might include human studies or laboratory experiments to determine health effects resulting from exposure to a given hazardous substance.

Superfund Amendments and Reauthorization Act (SARA)
In 1986, SARA amended CERCLA and expanded the health-related responsibilities of ATSDR. CERCLA and SARA direct ATSDR to look into the health effects from substance exposures at hazardous waste sites and to perform activities including health education, health studies, surveillance, health consultations, and toxicological profiles.

Surface water
Water on the surface of the earth, such as in lakes, rivers, streams, ponds, and springs [compare with **groundwater**].

Surveillance [see **epidemiologic surveillance**]

Toxic agent
Chemical or physical (for example, radiation, heat, cold, microwaves) agents that, under certain circumstances of exposure, can cause harmful effects to living organisms.

Toxicological profile
An ATSDR document that examines, summarizes, and interprets information about a hazardous substance to determine harmful levels of exposure and associated health effects. A toxicological profile also identifies significant gaps in knowledge on the substance and describes areas where further research is needed.

Toxicology
The study of the harmful effects of substances on humans or animals.

Tumor
An abnormal mass of tissue that results from excessive cell division that is uncontrolled and progressive. Tumors perform no useful body function. Tumors can be either benign (not cancer) or malignant (cancer).

Uncertainty factor
Mathematical adjustments for reasons of safety when knowledge is incomplete. For example, factors used in the calculation of doses that are not harmful (adverse) to people. These factors are applied to the lowest-observed-adverse-effect level (LOAEL) or the no-observed-adverse-effect level (NOAEL) to derive a minimal risk level (MRL). Uncertainty factors are used to account for variations in people's sensitivity, for differences between animals and humans, and for differences between a LOAEL and a NOAEL. Scientists use uncertainty factors when they have some, but not all, the information from animal or human studies to decide whether an exposure will cause harm to people [also sometimes called a **safety factor**].

Urgent public health hazard
A category used in ATSDRs public health assessments for sites where short-term exposures (less than 1 year) to hazardous substances or conditions could result in harmful health effects that require rapid intervention.

Volatile organic compounds (VOCs)
Organic compounds that evaporate readily into the air. VOCs include substances such as benzene, toluene, methylene chloride, and methyl chloroform.