Health Consultation

CRESTWOOD GROUNDWATER CONTAMINATION

CRESTWOOD, COOK COUNTY, ILLINOIS

Prepared by the
Illinois Department of Public Health

MARCH 25, 2011

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

Health Consultation: A Note of Explanation

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

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

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and the ATSDR Division of Regional Operations

Summary

Introduction

In response to community concerns, this health consultation was prepared to summarize the health-based evaluation of available environmental and human exposure data related to the contamination of groundwater that served as a source of drinking water for the Crestwood community. The chemical contamination in Crestwood Well #1 was first discovered in 1985, and then confirmed in 1998 and 2007. However, there is no information regarding the actual concentrations of these volatile organic chemicals (VOCs), including vinyl chloride, 1,1-dichloroethylene, trans-1,2-dichloroethylene and cis-1,2-dichloroethylene, within the Crestwood water distribution system at any time. The Illinois Environmental Protection Agency (Illinois EPA) has determined that the *estimated* levels of contamination of the Crestwood water system did not exceed the federal drinking water standards. However, IDPH and the Agency for Toxic Substances and Disease Registry (ATSDR) have determined that there is insufficient information available to know the *actual* magnitude of chemical exposures to individuals using the Crestwood water system as their source of drinking water. Unfortunately, the past levels of VOCs in the drinking water may never be known. As a result, we cannot conclude with certainty whether past exposure to contaminants in Crestwood drinking water could have harmed people's health. Currently, the Crestwood public water system obtains water from Lake Michigan water, which is treated at City of Chicago treatment plants, is tested frequently and is documented to meet regulatory standards.

Sampling of surface soil in Playfield Park has shown that the levels of lead are not a health-concern for exposure to children. Sampling has confirmed that the subsurface soil and shallow groundwater in areas of Playfield Park are not contaminated, so there is not a concern for exposure to people using the park for recreation. The area of highest contamination is the subsurface soil and shallow groundwater near the Playfield Dry Cleaners, which will be evaluated by the U.S. Environmental Protection Agency for potential migration of chemical vapors into the interior of businesses in Playfield Plaza Shopping Center.

Conclusion 1
We cannot conclude whether past exposure to contaminants in Crestwood drinking water could have harmed people's health. Currently, the Crestwood public water system obtains water from Lake Michigan water, which is treated at City of Chicago treatment plants, is tested frequently and is documented to meet regulatory standards.

Basis for Decision 1
There is uncertainty about when the contamination first impacted Well #1 and limited sampling information from 1985 until the well was no longer used in 2007.

Conclusion 2
The concentrations of lead detected in surface soil in Playfield Park are below health-based screening criteria and would not be expected to harm people's health.

Basis for Decision 2
IDPH reviewed the sample results and determined that all XRF readings for lead were less than the USEPA guidance level of 400 ppm for residential soil.

Conclusion 3
There is uncertainty about whether the chemical contamination in the subsurface soil and shallow groundwater in the area behind the Playfield Dry Cleaners could pose a hazard based on the potential migration into the interior of businesses within the Playfield Plaza.

Basis for Decision 3
The area of highest VOC contamination is the subsurface soil and shallow groundwater near the Playfield Dry Cleaners, which will be evaluated by the U.S. Environmental Protection Agency for potential migration of chemical vapors into the interior of businesses in Playfield Plaza Shopping Center.

Next Steps

- ATSDR and IDPH recommend that Illinois EPA and USEPA continue their investigation of village records to determine if additional data exist that would better characterize past exposures.

- ATSDR and IDPH recommend that USEPA or another entity evaluate the Playfield Plaza Shopping Center businesses for potential vapor intrusion of VOCs detected in subsurface soils and shallow groundwater near the Playfield Plaza dry cleaning facility.

- IDPH and ATSDR will follow the developments of these investigations and will review any additional data to determine whether the conclusions of this health consultation require revision.

For More Information

For more information about IDPH and ATSDR's work on the Crestwood Groundwater Contamination Investigation, you can contact Ken Runkle at 217-782-5830

Purpose

ATSDR received petitions to evaluate the potential health hazards related to the discovery of water contamination in Crestwood, Illinois. IDPH, a cooperative agreement partner of ATSDR, and ATSDR Region 5 staff were asked to review the available information to determine if exposure to chemicals in the groundwater in Crestwood poses a public health hazard. This consultation is a health-based interpretation of information relative to this situation.

Background and Statement of Issues

In December 2007, Illinois EPA determined that evidence suggested the Village of Crestwood had been using Crestwood Community Well #1, a known contaminated well, as a water source and mixing this well water with public water purchased from the nearby Village of Alsip for delivery to Crestwood customers. Illinois EPA reviewed Alsip billing records and operational reports for 2007 and further confirmed these suspicions through information obtained from the Crestwood public water supply operator. However, the duration and extent of the use of Well #1 was not yet known. In 2009, after additional information was gathered and records were obtained, Illinois EPA determined that from 1985 to 2007, Crestwood used water from Well #1 to supplement the water purchased from Alsip without informing the Illinois EPA or its water customers. [1]

Crestwood is located in Cook County, Illinois, about 6 miles southwest of Chicago. The Crestwood Community Water Supply provides water to approximately 11,000 persons (Figure 1). [2]

Site Description and History

Crestwood Community Well #1 was constructed in 1959 to a depth of 345 feet below the ground surface. The well is about 245 feet southeast of a dry cleaning facility in the Playfield Plaza Shopping Center in Playfield Park. Starting in 1972, Illinois EPA inspections documented that Lake Michigan water was being used as a primary source of drinking water for Crestwood public water, and that Well #1 was an emergency stand-by well. In 1985, under an Illinois EPA state-wide drinking water source sampling program for VOCs, a water sample from Well #1 was collected and analyzed by Illinois EPA and found to contain 1,1-dichloroethylene (DCE) at 2.8 micrograms per liter (µg/L). The source of contamination was not known.

In response to the detection of this contamination, Crestwood told Illinois EPA in 1986 that they would continue to purchase Lake Michigan water from the neighboring Village of Alsip as their sole source of drinking water. Crestwood Well #1 was only to be used as an emergency backup water source. Because of the designation of Well #1 as a backup supply, the federal Safe Drinking Water Act did not require the well to be sampled. [1]

In 2007, Illinois EPA implemented a new requirement to sample emergency wells of community water systems. The samples collected by both Crestwood and Illinois EPA showed vinyl chloride and cis-1,2 DCE in Crestwood Well #1 (Table 1).

In December 2007, Illinois EPA discovered that Crestwood had been supplementing the Lake Michigan water supply with water from Well #1. However, the extent of use was not known. Information about the use of the contaminated well had not been included in any of the operating reports submitted by Crestwood to Illinois EPA. This information also had not been disclosed to the public in the Crestwood annual Consumer Confidence Report. [1]

In December 2007, the Illinois EPA sent a Non-Compliance Advisory letter to Crestwood advising against future use of the contaminated emergency back-up well, stating that the use of

Well #1 was a violation of the Illinois Environmental Protection Act. In April 2008, Crestwood provided what Illinois EPA called "an unacceptable response" to the enforcement letter. Within a month, Illinois EPA responded with a Violation Notice for improper use of Crestwood Well #1 and for violation of the groundwater quality standard for vinyl chloride in the well. Illinois EPA took this enforcement action to ensure that a long-term solution was reached either to properly treat water produced by the Crestwood Well #1 or to properly abandon the well. On April 24, 2008, Illinois EPA resampled Well #1. [1]

In June 2008, Illinois EPA recommended to IDPH that notification should be made to the local media and area well owners of the potential threat of contamination to private water wells near Crestwood Well #1. Following the provisions of the Illinois Groundwater Protection Act, IDPH made that notice in August 2008. Later in August, the Crestwood public water supply operator admitted that Well #1 had been in use even though he had told Illinois EPA inspectors in November 2007 that Well #1 was not being used. This admission initiated further investigation. [1]

There is no available information about VOC testing of the finished drinking water in the Crestwood water system. To estimate how chemical contaminants in Well #1 may have impacted the drinking water quality in the system, Illinois EPA compared water supplier billing data to Crestwood pumping data. Based on an investigation of records, including monthly operational reports and on-site inspection of the public water supply meters dating to 1999, the volume of water taken from the contaminated well and then blended with the fully treated Lake Michigan water averaged about 10 percent of Crestwood's water distribution per month, with the greatest volume being no more than 20 percent of the total public water supply distribution per month. [1]

Continued investigation discovered an April 1998 letter to Illinois EPA from a consultant investigating a nearby dry cleaner at Playfield Plaza. This letter reported results from two samples collected from Well #1 in July 1, 1997. Both samples contained 3 µg/L of cis-1,2 DCE (Table 1).

In April 2009, the *Chicago Tribune* reported the Village of Crestwood's alleged use of a known contaminated well as a water source. On April 21, 2009, the Village of Crestwood hosted a public meeting to address community concerns and outrage.

On April 29, 2009, federal agents from the U.S. Environmental Protection Agency (USEPA) raided the Crestwood village offices. At the request of Illinois EPA, USEPA is conducting a criminal investigation of Village of Crestwood officials, in coordination with the U.S. Department of Justice (USDOJ). [3]

On May 9, 2009, Congressman Bobby Rush hosted a public meeting to discuss community concerns. Congressman Rush requested attendees from USEPA, USDOJ, Illinois EPA, and ATSDR. Many Crestwood residents expressed outrage over the use of the contaminated water and some shared concerns about whether cases of cancer among their families and friends could be caused by the contamination.

On June 8, 2009, Illinois EPA began an investigation of the potential source of the contamination of Crestwood Well #1. The investigation area included the Playfield Plaza Shopping Center, which has a dry cleaning facility and a possible underground storage tank, and the public area near Crestwood Well #1. Eleven borings were done at various depths down to bedrock throughout the investigation area (Figure 2). Illinois EPA found chlorinated VOCs in the shallow groundwater beneath the shopping center and near the suspected source behind the Playfield Cleaners facility. However, there were no detections of VOCs in any samples beyond the shopping center property in this shallow groundwater zone (Figures 3 and 4). [1]

In June 2009, the Illinois EPA Office of Site Evaluation conducted an investigation of the potential source of the contamination of Well #1. This investigation is described in detail in the environmental data section of this health consultation.

On June 9, 2009, the Illinois Attorney General filed a civil lawsuit that accused the Village of Crestwood of lying more than 120 times about the use of Crestwood Well #1. [4]

On June 25, 2009, Illinois EPA asked IDPH to review surface soil sampling data generated by an x-ray fluorescence (XRF) device used to determine lead levels in soil beneath and near the Crestwood water tower in Playfield Park.

On March 5, 2010, ATSDR released a Public Comment Version of a Health Consultation for the Crestwood Groundwater site prepared by ATSDR and IDPH. The document was made available online and in paper copy at a public meeting held Saturday, March 13, 2010 at Trinity Christian College. More than 100 persons attended the public meeting and shared their concerns with a panel of experts from ATSDR, IDPH, Illinois EPA and the University of Illinois at Chicago School of Public Health. The public comments from this meeting and others received by ATSDR and IDPH during the public comment period are included as an attachment to this document (Attachment 1).

On October 12, 2010, the USEPA Inspector General released a report stating that limitations in Safe Drinking Water Information System prevent USEPA from ensuring the status of emergency facilities such as Crestwood Well #1. Since there is no federal regulatory requirement for USEPA or states to monitor these emergency facilities, customers may face hazards from the misuse of water from these sources. USEPA is considering reporting and regulatory options. [5]

In December 2010, the Village of Crestwood settled a class-action lawsuit with residents who sued over the past use of Well #1. The Village established a fund to pay a partial reimbursement of water bills to former residents and businesses. Additionally, the village would keep Well #1 closed and hire an independent environmental consultant to report annually for three years on the results of water testing. Other lawsuits are pending against the Village.

Environmental Data

Crestwood Community Well #1 Sampling 1985 to 2009

No information regarding the sampling of VOCs in Crestwood Community Well #1 has been identified before 1985. In 1985, under an Illinois EPA state-wide drinking water source sampling program for VOCs, Well #1 was found to contain 1,1-DCE at 2.8 µg/L. DCE is a breakdown product of the dry cleaning solvent, tetrachloroethylene (PCE). Samples collected from Well #1 in 1998 by a consultant (Conestoga-Rovers & Associates), investigating a dry cleaner at the Playfield Plaza site, found another dry cleaning solvent breakdown product, cis-1,2 DCE, at 3 µg/L. Other possible site-related VOCs were not detected (Table 1).

In 2007, in response to a new requirement to sample emergency wells of community water systems, Illinois EPA and Crestwood both collected water samples from Well #1. The results showed the detection of cis-1,2-DCE in multiple sampling events of the well from 2007 to 2009 with a maximum level of 2.6 µg/L (Table 1). In addition, the 2007 to 2009 sampling also identified the presence of another breakdown product of PCE, vinyl chloride. Because vinyl chloride had not been reported in the 1985 and 1998 samples, it may have been first present in the well sometime after 1998.

In June 2009, the Illinois EPA Office of Site Evaluation began an investigation of the potential source of the contamination of Well #1. The investigation area included the Playfield Plaza Shopping Center, which has a dry cleaning facility and a possible underground storage tank, and the public area near Well #1. The purpose of this investigation was to gather information to help determine if the Playfield Plaza Shopping Center may have contributed to the contamination of Well #1.

From June 8 through June 11, 2009, Illinois EPA took 11 soil borings at various depths down to bedrock throughout the investigation area. Four soil samples and ten groundwater samples were analyzed. The soil cores also were visually inspected for staining and other signs of potential contamination, and screened for the presence of VOCs using a photoionization detector (PID). Detailed sampling methods, including boring logs are available on the Illinois EPA website at http://www.epa.state.il.us/community-relations/fact-sheets/crestwood-pws/update-2.html. The soil samples taken below the surface of the pavement at the Playfield Plaza Shopping Center showed that the chemical contamination was highest at location GP6, directly behind the Playfield Cleaners facility. The analysis detected the presence of the primary dry cleaning solvents, PCE and trichloroethylene (TCE), with lower levels of chloroform and 1,1,1-trichloroethane (Figure 4). The sampling results for the subsurface samples to the northeast from the dry cleaners (GP7 and GP9) were non-detect for VOCs. Since these samples were taken below the ground surface, there is no direct exposure to this chemical contamination. However, it does indicate that the area behind the dry cleaning facility contains a significant contamination source. The specific concern is whether chemical vapors in the subsurface soil could migrate into the interior space of the buildings within Playfield Plaza Shopping Center.

Groundwater samples were taken at specific depths below the ground surface. Illinois EPA found chlorinated VOCs (PCE, cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride) in the shallow

groundwater beneath the area of the Playfield Plaza dry cleaners where contamination was found in subsurface soils and also beneath the parking lot on the north side of the shopping center (Figure 3). However, VOCs were not detected in shallow groundwater samples taken in areas away from Playfield Plaza, including samples taken in the playground and baseball fields of Playfield Park that are near Well #1.

Using groundwater modeling methods, Illinois EPA and Illinois State Water Survey hydrogeologists predicted that pumping water from Well #1 could have pulled contaminants from the shallow groundwater into the well. To determine if this was how Well #1 became contaminated, Illinois EPA conducted a follow-up field investigation effort in September 2009. A monitoring well was installed into the bedrock layer that defines the lowest level of the shallow groundwater. This bedrock monitoring well was installed at a depth of 49 feet at a location midway between the dry cleaning facility and Well #1. Samples from the bedrock monitoring well detected the same contaminants found in Well #1 and the shallow groundwater near the Playfield Plaza dry cleaners, including vinyl chloride (55.7 µg/L), cis-1,2-DCE (14.0 µg/L), and trans-1,2-DCE (0.57 µg/L), reported as averages of two samples. The detection of contamination in this monitoring well confirms that Well #1 became contaminated by pulling water from this shallow groundwater layer. Based on these findings, Illinois EPA has concluded that the Playfield Plaza dry cleaning facility is the source of the well contamination. [1]

In response to community concerns about possible lead contamination in the surface soil beneath the Village's water tower, Illinois EPA tested surface soil at five locations using an XRF device (Table 2). The highest lead level detected was 269 parts per million (ppm).

Discussion

Chemicals of Interest

Groundwater

IDPH and ATSDR compared the results of each sample collected from Crestwood Well #1 with the appropriate comparison values, specifically the ATSDR health based criteria (CREG -- Cancer Risk Evaluation Guide, and EMEG -- Environmental Media Evaluation Guide) and the USEPA maximum contaminant levels (MCLs) for drinking water, to select chemicals for further evaluation for exposure and possible carcinogenic and non-carcinogenic health effects (Table 1). CREGs and EMEGs are health-based screening criteria that are used to evaluate environmental sampling results for potential health hazards. MCLs have been established by USEPA as enforceable drinking water standards that public water supplies must meet.

Chemicals found at levels greater than the health-based screening criteria or MCLs were selected for further evaluation. Neither IDPH nor ATSDR were involved in the collection of the groundwater sampling data. Both relied on the data quality assurance procedures of the Illinois EPA to ensure that the results cited in this assessment are valid.

The contamination of Well #1 appears to consist of breakdown products of the dry cleaner solvent PCE, although PCE has not been detected in any of the Well #1 samples. 1,1-DCE was found in samples collected in 1985 and cis-1,2-DCE was found in 1998, 2007 and 2008. Vinyl chloride, a later breakdown product of PCE, was not reported to have been detected in the 1985 and 1998 samples, and was first reported to be detected in 2007. However, it should be noted that there is no sampling data for VOCs in Crestwood Well #1 prior to 1986 and no VOC testing at any time in the Crestwood water distribution system.

The concentrations of 1,1-DCE, cis-1,2-DCE , or trans-1,2-DCE detected in the limited sampling of Crestwood Well #1 did not exceed either the ATSDR health-based screening criteria or the MCLs for the respective chemicals. The highest level of vinyl chloride detected in Crestwood Well #1 was 5.4 µg/L in October 2007, which exceeds the ATSDR cancer-based screening criteria (0.03 µg/L) and the MCL (2 µg/L). Vinyl chloride was again detected in Well #1 at 4.9 µg/L in April 2008. Therefore, the primary chemical of concern for the Crestwood water system is vinyl chloride.

Soil

Lead is the chemical of interest in surface soil at Playfield Park and was a community concern due to past sandblasting of the water tower to remove paint that contained lead. IDPH reviewed the sample results and determined that all XRF readings were less than the USEPA guidance level of 400 ppm for residential soil. On June 30, 2009, IDPH sent a letter to Illinois EPA stating that the level of lead detected in soil did not exceed the residential soil screening level and would not pose a health hazard to children using the park. Lead in surface soil will not be evaluated further in this health consultation.

Exposure Evaluation

A chemical can cause an adverse health effect only if people contact it at a sufficient level for a sufficient amount of time. That requires:

- a source of exposure,
- an environmental transport medium,
- a point of exposure,
- a route of exposure, and
- a receptor population.

A pathway is complete if all its components are present and exposure of people occurred in the past, is occurring, or will occur in the future. If parts of the pathway are absent, data are insufficient to decide whether it is complete, or exposure may occur at some future time, then it is a potential pathway. If part of the pathway is not present and will never exist, the pathway is incomplete and can be eliminated from further consideration (Table 3).

The potential for exposed persons to experience adverse health effects depends on these three factors:

- how much of each chemical a person contacts,
- how long a person is exposed, and
- the person's health condition at the time of exposure.

Since there is no VOC sampling data for Crestwood Well #1 prior to 1985, it is not known when the well was first impacted by the groundwater contamination. From at least 1985 to 2007, the consumption of contaminated water from Crestwood Well #1 was a completed exposure pathway. Vinyl chloride was not reported in the 1985 Illinois EPA and Crestwood samples of the well and was not reported in the 1998 sample collected by a private consultant. The first reported detection of vinyl chloride in Well #1 was 2007.

Since there is no sampling data, the actual levels of VOCs in the finished Crestwood drinking water before the closing of Well #1 in 2008 are not certain. Crestwood mixed water pumped from Well #1 with water purchased from the Village of Alsip that was stored in 2 one million gallon tanks. There also is a water tower that floats additional storage of purchased water on top (i.e., pressure head and additional volume of water) of the Crestwood distribution system. The groundwater from the well was mixed with the purchased water stored in the 2 million gallon tanks. Illinois EPA review of available water records suggest that the actual blending rate over time was less than 10% of Crestwood Well #1 water and greater than 90% of Alsip water, which comes from Lake Michigan. Based on available information, the maximum blending rate of Well #1 use was 20% over short periods.

If these blending rates are accurate, then the highest estimated concentration of vinyl chloride in the finished drinking water is calculated by a dilution of the maximum concentration in Well #1 (5.4 µg/L) by a factor of 5 (assuming 20% blending rate). This estimated concentration (1.08 µg/L) is less than the USEPA drinking water standard (2 µg/L). Although it exceeds the ATSDR cancer-based screening criteria (0.03 µg/L), it still falls within EPA's acceptable risk range (less than 1 in 10,000 excess cancer risk).

$$Final\ \ concentration\ \approx\ 5.4\,\mu g/L \times 0.2\ \approx\ \ 1.08\ \mu g/L$$

Health Outcome Data

Community concern regarding cancer rates prompted IDPH to look at the cancer incidence in zip code 60445, which covers the communities of Crestwood and Midlothian. In 2006, IDPH released a cancer incidence report that looked at rates for zip code 60445. This assessment was conducted before public disclosure of the contamination in Crestwood Well #1. The evaluation of community cancer rates are generally performed at the zip code level, since that is how the cases are reported to the state cancer registry. Community concern regarding cancer rates in the area prompted this evaluation before the Crestwood well contamination became known to IDPH and the public. This report found that the incidence for the period 1998 to 2002 in white males (304 observed vs. 272 expected) and white females (322 observed vs. 342 expected) was not statistically different from expected rates. [6]

In response to community concerns, IDPH initiated a follow-up assessment of the cancer incidence specifically for residents in the Crestwood community for the years 1994 to 2006. [7]

The report entitled "Incidence of Cancer in the Village of Crestwood, Cook County Illinois, 1996 - 2006" was released March 5, 2010. IDPH concluded that there were several cancers statistically elevated in Crestwood, including lung cancer in males and females, kidney cancer in males, and most gastrointestinal cancers in males. All the increases were limited to whites, which made up more than 90 percent of the potentially exposed population. IDPH stated that several risk factors including smoking, diet, heredity, and workplace exposures are known to be associated with these cancers, but could not be evaluated. Exposure to PCE and its degradation products in the Crestwood water also may be associated with these cancers. The report stated "due to methodological and data limitations, however, the assessment could not establish with certainty this relationship, nor rule out such a possibility." [8]

Child Health Considerations

IDPH and ATSDR recognize that children are more sensitive to some contaminants than adults. Children receive a higher dose when exposed to the same contaminant level in water. Therefore, IDPH and ATSDR included children when evaluating exposure to vinyl chloride in the Crestwood public water system.

Conclusions

There is historical evidence of contamination of Crestwood Well #1 with chemicals derived from a dry cleaning solvent, based on three sampling periods beginning in 1985. There is uncertainty about when the contamination first impacted Well #1 and limited sampling information from 1985 until the well was no longer used in 2007. Illinois EPA estimates of the concentration of VOCs in the drinking water during the period from 1985 to 2007 did not exceed federal drinking water standards. However, IDPH and ATSDR recognize that the available information does not provide sufficient information to determine the *actual* levels of chemical contamination that were present in the Crestwood public water system during that time. Unfortunately, the levels of exposure to Crestwood residents may never be known. We cannot conclude whether past exposure to contaminants in Crestwood drinking water could have harmed people's health. Currently, the Crestwood public water system continues to purchase and supply water from Alsip, which obtains their water from Lake Michigan through the City of Chicago. Crestwood drinking water is tested regularly and meets federal and state drinking water standards.

The concentrations of lead detected in surface soil in Playfield Park are below health-based screening criteria and would not be expected to harm people's health.

Sampling of the shallow groundwater at several locations in Playfield Park and to the south of the source area in Playfield Plaza did not detect VOCs. Therefore, there is no evidence of migration of vapors into ambient air in Playfield Park or into homes to the east of Crestwood Well #1. However, there is uncertainty about whether the chemical contamination in the subsurface soil and shallow groundwater in the area behind the Playfield Dry Cleaners could pose a hazard based on the potential migration into the interior of businesses within the Playfield Plaza.

Recommendations

IDPH and ATSDR recommend that:

- Illinois EPA and USEPA continue their investigation of village records to determine if additional data exist that would better characterize past exposures.
- USEPA or another entity evaluate the Playfield Plaza Shopping Center businesses for potential vapor intrusion of VOCs detected in subsurface soils and shallow groundwater near the Playfield Plaza dry cleaning facility.

IDPH and ATSDR will follow the developments of these investigations and will review any additional data to determine whether the conclusions of this health consultation require revision.

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References

1. Crestwood Public Drinking Water Supply Contamination, Fact Sheets, May - June 2009. Illinois Environmental Protection Agency. http://www.epa.state.il.us/community-relations/fact-sheets/crestwood-pws/index.html

2. Crestwood Public Water System Details. Illinois Environmental Protection Agency, Bureau of Water. Available from URL: http://163.191.83.31/dww/ Accessed June 24, 2009.

3. U.S. Raids Crestwood Offices in Water Probe. Chicago Breaking News Center. Available from URL: http://www.chicagobreaking news.com Accessed June 25, 2009.

4. Illinois Attorney General. Madigan Files Suit against Village of Drinking Water, June 9, 2009 press release. (http://www.ag.state.il.us/pressroom/2009_06/20090609.html)

5. EPA Lacks Internal Controls to Prevent Misuse of Emergency Drinking Water Facilities. USEPA Report Number 11-P-0001. October 12, 2010.

6. Incidence of Cancer in ZIP Code 60445 of Midlothian and Crestwood (Cook County), Illinois, 1998-2002. Illinois Department of Public Health. July 2006.

7. Ries LA, Smith MA, Gurney JG, Lind M, Tamra T, Young JL, and Bunin GR (eds.) *Cancer Incidence and Survival among Children and Adolescents: United States SEER Program 1975-1995,* pp. 9-12, National Cancer Institute, SEER Program. NIH Pub. No. 99-4649. Bethesda, MD. September 1999.

8. Incidence of Cancer in the Village of Crestwood, Cook County Illinois, 1994 – 2006. Illinois Department of Public Health. March 2010.

9. Agency for Toxic Substances and Disease Registry. Toxicological profile for vinyl chloride. Atlanta: U.S. Department of Health and Human Services; 2006 July.

Table 1. Summary of Known Water Sample Results from Crestwood Well #1 in µg/L.

Date	Sample collected by	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	Vinyl chloride
Nov. 1985	IEPA	2.8	nr	nr	nr
Aug. 1986	Crestwood	nr	nr	4	nr
Nov. 1986	IEPA	nr	nr	5	nr
Nov. 1998	CRA	nd	3.0	nd	nd
Sept. 2007	IEPA	nd	2.6	nd	1.5
Oct. 2007	IEPA	nd	1.6	nd	5.4
April 2008	IEPA	nd	1.1	nd	4.9
June 2008	IEPA	nd	1.3	nd	4.4
Nov. 2008	IEPA	nd	0.54	nd	2.1
Jan. 2009	IEPA	nd	0.75	nd	2.4
MCL		7	70	100	2
ATSDR EMEG		90 (child) 300 (adult)	3,000 (child) 10,000 (adult)	2,000 (child) 9,000 (adult)	30 (child) 100 (adult)
ATSDR CREG		na	na	na	0.03

µg/L = micrograms per liter
DCE = dichloroethene
nr = chemical was not reported
nd = chemical was not detected
na = not applicable, chemical is not considered to be a carcinogen
MCL = maximum contaminant level (USEPA federal drinking water standard)
EMEG = Environmental Media Evaluation Guideline- concentration in drinking water not associated with adverse health impacts for long-term exposure
CREG = Cancer Risk Evaluation Guide- concentration in drinking water associated with an increased cancer risk of 1excess cancer in 1 million exposed individuals

"Sample collected by" is the entity that collected and reported the sample results: Crestwood refers to the Village of Crestwood Water Department; CRA refers to Conestoga-Rovers and Associates who were investigating the Playfield Plaza site; IEPA refers to samples collected by the Illinois EPA

Table 2. X-Ray Fluorescence (XRF) Results for Playfield Park; June 11, 2009.

Sample Number	Depth	Lead Level in ppm
1	surface	67
	3 inches	62
2	surface	99
	3 inches	224
3	surface	269
	3 inches	57
4	surface	48
	3 inches	69
5	surface	89
	3 inches	37

ppm = parts per million

Table 3. Exposure Pathway Analysis for Groundwater Contamination in Crestwood

Pathway	Source	Media	Point of Exposure	Exposure Route	Exposed Population	Time	Completed Pathway
Public water supply	Dry cleaning operation	Crestwood Drinking water	Residential tap	Ingestion	Residents	Past	Complete
						Present	Incomplete- due to well closure
						Future	
Soil	Dry cleaning operation	Subsurface soil and ground water	Playfield Park	Ingestion Dermal	Recreational users	Past	Incomplete- no VOC subsurface contamination
						Present	
						Future	
	Dry cleaning operation	Subsurface soil and ground water	Playfield Plaza	Ingestion Dermal	Customers of Playfield Plaza businesses	Past	Incomplete- due to pavement cover
						Present	
						Future	
	Paint on Water Tower	Surface soil	Playfield Park	Ingestion Dermal	Recreational users	Past	Complete
						Present	
						Future	
Ambient Air	Dry cleaning operation	Air	Playfield Park	Inhalation	Recreational users	Past	Incomplete – no VOC soil contamination
						Present	
						Future	
Indoor Air	Dry cleaning operation	Air	Playfield Plaza businessed	Inhalation	Workers and Customers	Present	Unknown
						Future	
						Future	

Figure 1. Map of service area for Crestwood Water Supply

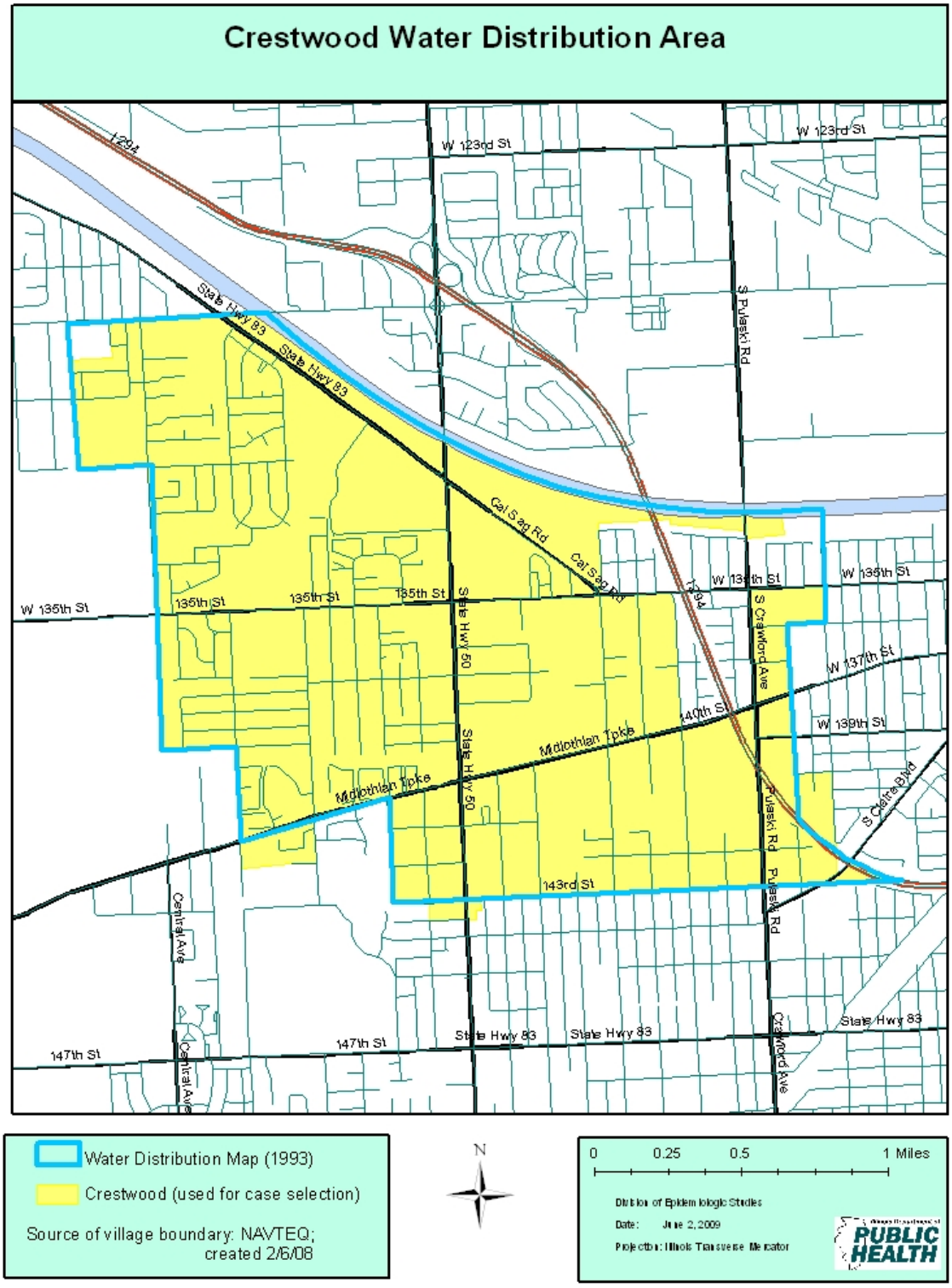


Figure 2. Locations of 2009 Illinois EPA Soil Borings

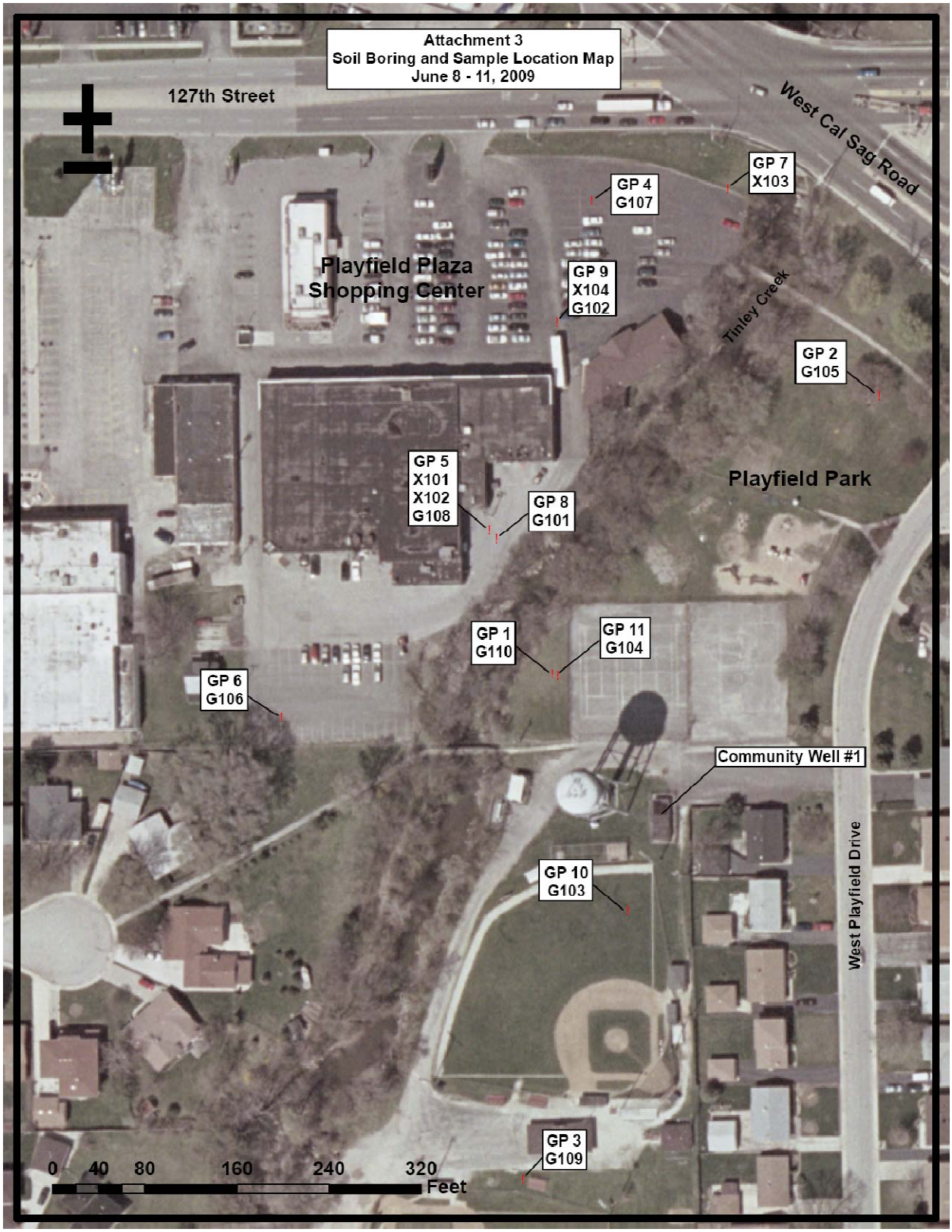


Figure 3. Illinois EPA 2009 Groundwater Sampling Results Summary Map

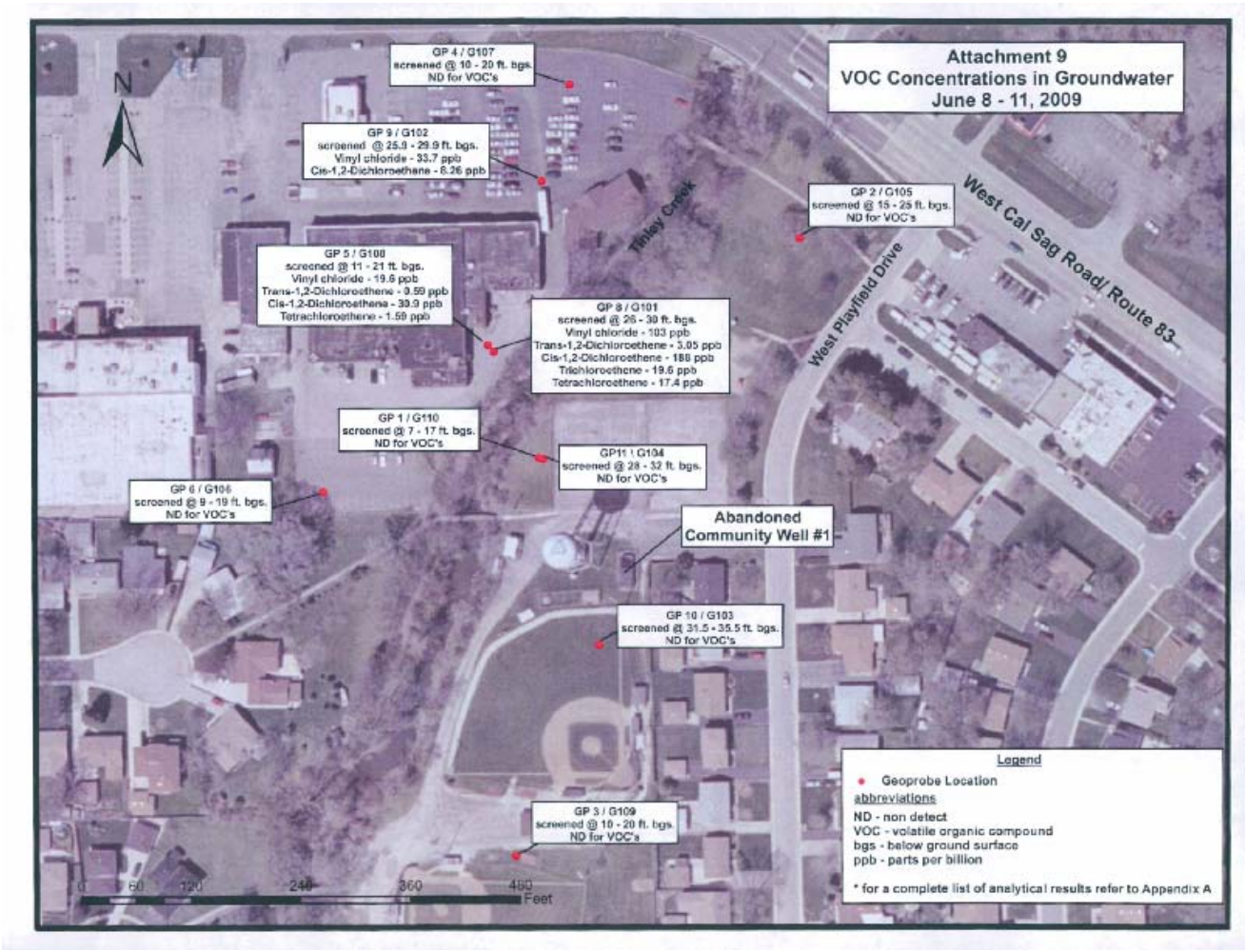
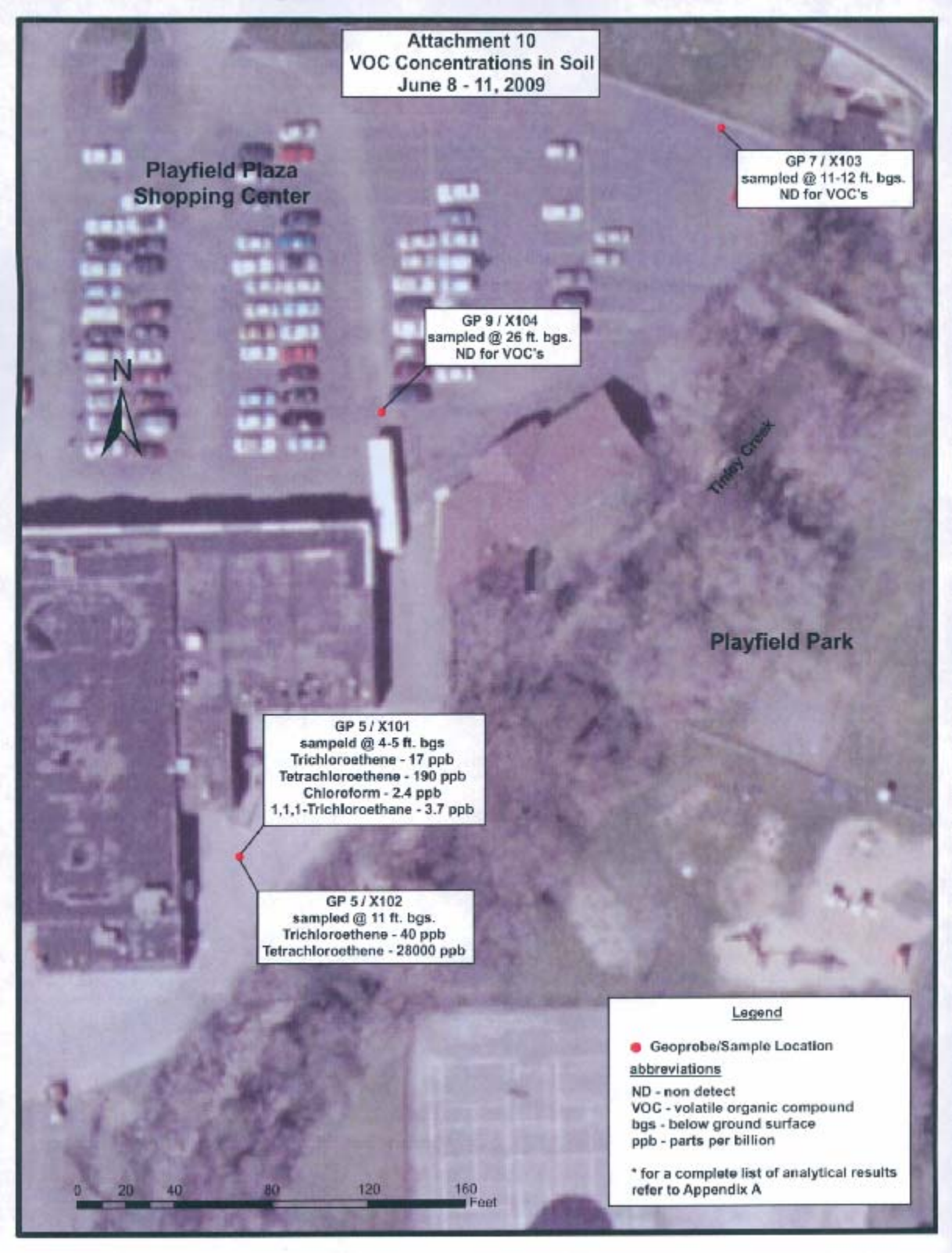


Figure 4. Illinois EPA 2009 Soil Sampling Results Summary Map



Attachment 1

Responses to Questions and Comments from the Public Comment Period

The following questions and answers were shared at the March 13, 2010 Crestwood Public Meeting

Has the current Crestwood tap water been tested?

Yes, it is tested routinely by the water plant operators. An annual water test report is inserted into the bill of residents once a year. For information about water testing, you may go to Illinois Drinking Water Watch at http://163.191.83.31/dww/index.jsp and enter Crestwood for the "water system name".

Is Crestwood water safe to drink today?

Yes. Crestwood drinking water is tested regularly and meets federal and state drinking water standards. For information about water testing, you may go to Illinois Drinking Water Watch at http://163.191.83.31/dww/index.jsp and enter Crestwood for the "water system name".

Based on what you currently know, would you have allowed your own family to drink the Crestwood water from 1985-2007?

Yes, based on the available data; however, the data are very limited. We do not know the actual exposures over this entire period, but based on existing information, it is unlikely that drinking water standards were exceeded at the tap.

How can we get our tap water tested?

Since the municipal drinking water supply is regularly tested by the City of Chicago and the Village of Alsip, it is not necessary for you to independently test your tap water. The sample results for your regulated water supply are available from Illinois EPA and in the annual report issued by the utility. If you have a private well on your property and you are using it as a source of water for your home, it should be tested to ensure that it is safe to use.

What about the water quality at local restaurants and other establishments?

The Crestwood municipal water used by local restaurants and other businesses is the same source used by residents, which is regularly tested to ensure that federal and state drinking water standards are met.

Is it true you would have to drink 2 liters a day for 70 years to have a 2 to 3 chance out of 100,000 to start cancer in your body?

In this health consultation, we assumed residents were drinking 2 liters of Crestwood water per day to estimate exposure. Also, we took into account how many years a resident may have been

exposed over their lifetime. The exposure estimates used to calculate health and cancer risks were very conservative. It was estimated that the potential increased cancer risk was 2 or 3 cancers per 100,000 people. For added perspective, in the U.S., it is estimated that approximately 1 in 3 persons in the U.S. will be diagnosed with cancer at some point in their lifetime.

Can bathing in Crestwood water give you cancer?

The primary way to be exposed to the contamination in the water was by drinking it. Dermal absorption (through the skin), of VOCs from the water is a relatively small contribution to your potential exposure.

Was a study done of neurological disorders (such as seizures, dyslexia, attention deficit disorder, etc.) in reference to these chemicals?

The health outcome study only looked at cancers because there is a state-wide tracking system to allow us to compare cancer rates in Crestwood with other communities in Illinois. Unfortunately, we do not have other disease tracking systems in place for things like asthma, neurological disorders, or heart disease at this time.

However, based on the information we have on the levels of contamination in the Crestwood water supply, we do not feel that people would have experienced neurological problems from those levels of exposure.

If vinyl chloride is a carcinogen, any exposure is unacceptable. Everything I read claims there is no acceptable level of VOCs. Why are EPA standards different? Why do you say 2 parts per billion (ppb) is acceptable?

The USEPA drinking water standard or maximum contaminant level (MCL) is the maximum permissible level in a public water supply, which is 2 ppb for vinyl chloride. The maximum contaminant level goal (MCLG) is a non-enforceable health goal that USEPA sets at 0 ppb for all carcinogens in drinking water. MCLs are set as close to the MCLG as feasible using the best available analytical and treatment technologies and taking cost into consideration. There is a minimal cancer risk associated with exposure to vinyl chloride in drinking water at 2 ppb.

Could Clark/Premcor be a factor?

Determining if Clark/Premcor Refinery was a factor in the cancer cases cannot be determined because such data is not available.

Have you considered the impact of "canal water" infiltrating the public well and its health impact on the residents?

Groundwater and surface water both flow toward the Cal-Sag canal rather than away from it. In this area, we would expect groundwater to move toward the stream, and then toward the canal. Therefore, any contaminants in the canal are not likely to move upgradient toward the well. In

addition, it is unlikely that the canal water would have been drawn into the contaminated well because of the depth of the municipal well (350 feet).

In the analysis and comparisons section of the cancer report, it lists the commonly used site groups that were included in the study. Hodgkin's Lymphoma was included in this list, but is not included in the study results. Why is this so?

IDPH used a list that follows the national standard, which organizes cancers in different categories. If there are only a small number (five to six cases) of a certain category of cancer, we merge those cases with those for a similar category for our statistical comparisons.

Do you know what the water sample results are over the years and what does that mean?

Based on limited available data on the levels of chemical contaminants in the Crestwood well and what we know about the mixing rates for the drinking water supply, we would not expect past contaminant levels to have exceeded drinking water standards. Since we only have sampling data from a few time points over 23 years, we can only estimate what people may have been exposed to over that time. Unfortunately, we may never have complete information from the past, an uncertainty that is noted in our report.

From examining mixing and distribution records, Illinois EPA was able to establish the amount of water being distributed and billed to the community. Illinois EPA concluded that more water was being distributed than being purchased. On average, over time, Illinois EPA found that about 10% of the water being distributed to Crestwood citizens came from well #1 and about 90% came from purchased water from Alsip. Additionally, Illinois EPA found that the ratio may have fluctuated to as high as 20% well water and 80% Alsip water. In exposure estimates, IDPH and ATSDR conservatively estimated that 20% of the water over 20 years was coming from well #1.

How do we know that an individual cancer case was used as part of this study?

It is state law for hospitals, doctors, and laboratories to report cancer diagnoses to the cancer registry at IDPH. The state has established procedures to ensure the accuracy and completeness of the registry. It should be noted that the information in the registry represents the residency of the individual at the time of diagnosis. For example, if someone lived in Texas most of their life and moved to Crestwood and was then diagnosed with cancer, that would be included in the Illinois Cancer Registry as a Crestwood cancer case.

How does one get on the cancer registry?

In Illinois, a statute exists requiring **every** healthcare provider report **any** cancer diagnosis to IDPH. It is not something that an individual does on their own. For the cancer incidence study, IDPH used data from the state cancer registry, specifically from Crestwood. Staff members are appropriately trained on updating the cancer registry to avoid double counting and to ensure the highest level of compliance.

What type of household water filter is effective in eliminating these chemicals from the drinking water?

The National Sanitation Foundation has several methods that can be used to remove vinyl chloride from drinking water (see www.nsf.org). However, the most economical solution is using activated carbon. Residents should follow the directions for maintaining any water treatment system.

What type of kidney cancer has been identified?

The information recorded in the Illinois Cancer Registry follows a standard classification system. Using that system, all kidney cancers are included in one category for analysis, without identifying the specific type of kidney cancer. As a result, they did not report the specific types of kidney cancers in the report, even though kidney cancers of different types were collected by the registry.

Has IDPH studied the number of cancer deaths related to the contamination period?

In the assessment, only the cancer incidence (newly diagnosed cases) was studied. Deaths were not included because this would use a different set of data, based on deaths caused by cancer. The National Cancer Institute has historical records to evaluate cancer deaths associated with the period of the contamination. However, the interpretation of cancer death rates can be misleading because several variables must be taken into consideration. These include the stage of diagnosis, type of treatment received, location of treatment, and other risk factors associated with cancer survivability. As a result, the evaluation of cancer incidence is more informative about potential risk factors that may be involved in causing cancer.

Since 1985, is there any information that suggests there were any breaks in the pipelines from Lake Michigan to Crestwood? (I ask this because Crestwood never issued any type of watering bans).

No information is available to us regarding this issue.

How does the liver function of Crestwood residents compare to other populations?

Screening of the general population for liver function status is not conducted. Such tests are performed to assist physicians with individual diagnosis and therefore are not recorded by any agency. Comparisons among liver function differ between individuals and cannot be easily compared; therefore, it is best to discuss this individually with your physician. Any medications taken into the body (including aspirin or high blood pressure medicine) goes into the bloodstream, which filters through the liver. Everyone has certain liver function levels, but in this case liver functionality was not tested. The epidemiological studies identifying vinyl chloride as a known human carcinogen included a number of studies of liver function; however, the subjects with advanced stage liver cancer still had normal liver function levels.

Can the VOCs in the Crestwood water cause abnormal brain development, Asperger's Syndrome or Autism?

The VOCs detected in the Crestwood Well primarily affect the liver and kidneys. While exposure to these chemicals can affect the nervous system at much higher concentrations, there is no definite information linking them to abnormal brain development, Asperger's Syndrome or Autism.

Could employees who worked in Crestwood businesses, but were not residents of Crestwood be included in the cancer study?

No. The Illinois Cancer Registry records the address of the person at the time of their cancer diagnosis. Since the study only looked at people living in Crestwood at the time of their cancer diagnosis, non-residents would not be in the study population.

Can the VOCs in the Crestwood water cause kidney disease?

Exposure to the VOCs detected in the Crestwood Well water has been associated with adverse effects on the kidney at high levels of exposure. However, the ***levels*** of VOCs detected in the well water were much lower and would not be expected to cause kidney disease.

Has anyone sampled the water and sediments in Tinley Creek?

In 1997, a contractor to a local developer took a water sample from Tinley Creek, upstream from the Playfield Plaza shopping center, and detected a low level of one VOC. VOCs are volatile and readily evaporate into the air from surface water, so levels of VOCs would be expected to be low in flowing stream. Although there is no data regarding sediment sampling in Tinley Creek, given what we know about the general chemical properties of VOCs, we would not expect them to be present in the sediment.

Can the VOCs in the Crestwood water cause Parkinson's disease?

Exposures to the low levels of VOCs detected in the well water have not, in studies that we have seen, shown any links to Parkinson's disease. Studies of workers exposed to very high levels of VOCs in the workplace do have health issues related to their nervous system. The amount of exposure is correlated to the health effects. Most of the existing research comes from studies where workers had been exposed to concentrations tens, hundreds, or thousands times higher than what was observed in the Crestwood water. These are known as "high level exposure" studies, which can create challenges when comparing to lower levels of exposure.

Might the water contamination have affected Crohn's disease?

There are a variety of things such as alcohol that when consumed can irritate the gastrointestinal tract of those with Crohn's disease, but are not causative factors. Unless exposure was hundreds of times higher than what was observed, then one would not expect an identifiable reaction. There is no association between exposure to VOCs and the development of Crohn's disease.

How do we know that we were not getting 100% of our water from the contaminated well? Other local towns ran out of water during the drought season; how do we know the water was mixed?

Based on records that Illinois EPA obtained as part as their enforcement action, most of the water delivered to Crestwood homes came from Alsip. Additionally, the population of the Village of Crestwood exceeds the production level of the contaminated well. When the well was constructed in 1959, the population of Crestwood was about 4,000. At that time, the pump rate was approximately 250,000 gallons per day. The current demand for Crestwood is more than one million gallons per day, so the contaminated well alone could not have supplied the entire water demand of Crestwood.

Could we have received 100% of the contaminated water before the next "shipment" without being informed? What if it was from where we were getting the water supply in and they were running out they could have given us that 100% before they would have gotten the next shipment of the water supply in, we would not have known about it right?

It is to our understanding that the well water was pumped to reservoir tanks (located on Route 83) where it was then mixed with the Lake Michigan water. From this point, the mixed water was distributed to the water supply system and into the community. We have no evidence that there was a direct connection from the well to the system.

Did vinyl chloride only show up in 2007, or was it also tested in 1985 when other contaminants were discovered?

Vinyl chloride was found in 2007 and 2008 samples, and not reported in other samples collected in 1985, 1986, or 1997.

How long was the dry cleaner located in Crestwood?

The building was constructed in the early 1960s and the dry cleaner is still operating. We do not know when contamination was released since it is unknown how the dry cleaning solvents were handled in the past. They may have been placed into an outdoor storage tank that leaked or simply dumped behind the building.

Is there a correlation between vinyl chloride and learning disabilities?

The causation of learning disabilities is complex and a focus of concern and research today. We do know that short term exposure to high doses of VOCs, like vinyl chloride, is associated with feeling light-headed or "drunk," and can cause problems with peripheral nerves (like found in the hands). However, there is no evidence to link exposure to the VOCs detected in the Crestwood well and learning disabilities.

Why wasn't the well capped? Will this site ever be remediated?

In 1985, when the contamination came to light, the state had no authority to force the well to be capped. Illinois EPA offered the water suppliers several options: finding a different source of water, capping the well, or putting it on standby. Illinois EPA and USEPA are working together now to assess this issue and avoid similar situations in the future.

Are there processes or procedures in place to monitor new cases of cancer in Crestwood?

Cancer incidence is continuously monitored across the country, and Illinois has a nationally ranked cancer registry. New cases of cancer in Crestwood are reported on an ongoing basis to the Illinois Cancer Registry.

The following is commentary provided by email from an Illinois resident. The IDPH/ATSDR response is provided at the end.

Strong preponderance of evidence vs. weaker?
In responding to this case, you have done a sufficient job of examining the information. Thus far you have taken the standard approach in letting the facts speak for themselves. In considering causation you have taken the stronger examination of the evidence; whereby you haven't indicated statistical correlations, regression modeling, etc. with regards to comparing exposure and health effects. Also, the uncertainties and likelihood of multiple factors contributing to the observed adverse health effects prevents you from presenting a confident direct link. I know that this was constrained by insufficient and sparse data.

However, I want to know if you have considered taking a weaker approach? In protecting the health of the environment and the public, wouldn't a precautionary analysis also be prudent to at least briefly consider? *What hypothesis can you generate, such that you can further investigate additional exposure and potential links to health effects in Crestwood and surrounding communities?* Taking a weaker approach would allow you to speculate on concentrations that could have been in existence prior to 1986, and broaden the scope of your considerations.

Clarification: It would be helpful to put things into context with regards to actual risks. While the study indicated 2-4 and 4-8 additional cases of cancer per 100,000. Specifically point out that the population of Crestwood is closer to 10,000 and that for the population itself the elevated cases would be even less than 2-4 and 4-8 (as indicated for 100,000 citizens).

Monitoring: Given the past incidences of environmental releases, and the potential for more incidences of sicknesses and cancer (due to latency periods etc). It would be good for you to formally request and develop an environmental and health monitoring system. *What programs will be initiated in Crestwood itself to monitor not only the environmental conditions, but also to re-assess the adverse health effects on the population?* For instance, create a monitoring program where every 4 years a series of follow-up reports are generated. The contents of which:

1. Cite environmental releases, contaminants (and concentrations) that occurred over that time period in Crestwood. This may be a re-iteration of federal, state, or county reporting,

but should include environmental monitoring conducted by a government organization (I would think IEPA could take on this part).

2. Then in the context of releases or potential exposure, re-evaluate the cancer study (yes actually redo the study) as well as, examine additional sicknesses that could occur (not just cancer). *Specifically, given the releases into air, water, soil, and any current contaminants, what adverse health effects could be expected?*

I understand the minimal impact such low concentrations can have, however *I think it would be prudent to more expressly state that the concentrations are low (and investigate medical/ toxicological literature) that would provide more insight into low dose exposures of these VOCs. There has been mention of this in the reports, but a separate report might make the point clearer to the public.*

More information:

To better understand the dynamics of groundwater flow in the area and the nature of the VOCs in question, more specific information should be provided to the public. *Have reports been created? Why hasn't the public been provided access to them?* Either way, while some information is reported regarding Well #1, more statistics and information need to be shown. The well is 345 feet deep. Records from the Illinois Geologic Survey show that a 12 casing was installed from 0 to 38 feet depth:

1. To understand the specifics of the aquifer and fluid dynamics:

    a. *Where does the aquifer reside in this depth profile (with and without regard to a cone of depression)?*

    b. Now, in the remaining sections of the well, *does groundwater exist anywhere else? Does it extend to a deeper level (i.e. down to 345 feet)?* Is there another aquifer somewhere along the 345 ft. depth?

    c. How was the casing installed? *Are there gaps in the annular space that could act as a route of migration between the levels (and or the surface)?* I understand the well is now sealed, but *what records are there on the maintenance of the well when it was installed, and during its operation?*

2. The VOCs of concern in this case are denser than water and will sink through the aquifer. What modeling has been done to examine how contaminants (DCE-phases, and vinyl chloride) move from the PRP (dry cleaners) to Well #1? This needs to show a temporal transition, as well as projected concentrations of each phase over time (given the concentrations of phases at the well at differing times).

3. Once these models have been developed, explain how living in proximity to the well may or may not influence your health (presenting both projected concentrations and anticipated health effects and probabilities of cancer(s).

4. In a sense, what are the projected concentrations of soil vapor in the area, both adjacent to the well and within a given radius of risk?

5. Is the bedrock acting as a migration source at lower levels (below the 38 ft area where water is drawn from)? Such that testing at shallow levels does not reflect deep sources that could over time release contaminants both laterally and vertically through groundwater to the surface via vapor intrusion.

6. As these chemicals move deeper into the ground, how is their degradation influenced? Is bacterial breakdown elevated or depleted given the change in aerobic/anaerobic bacterial activity?

Mutli-component chemical influence:

1. While PCE derivatives (aside from vinyl chloride) were excluded; *what are the long-term effects of drinking the DCE phase chemicals over the time period from 1986-2007?* What links are there to non-cancer health effects? Could this low-dose exposure lead to decreased immunity and increased vulnerability to other medical conditions? If so, please note specific health effects by target organ. Even though the levels were below the MCLs I see this as an opportunity for empirical evidence, specifically, *could these levels below the MCL actually cause adverse health effects?* (This should be thoroughly reviewed in the context of how the original MCL was set and cross-examined from a legal and medical viewpoint).

    a. I realize this information is summarized well in ATSDR website information. However, I think providing some specific insight would be beneficial to the community.

2. *At the same time, how does a combined chemical exposure affect the body?* Are vinyl chloride and DCE compounds synergistic, antagonisticetc? Does the combination of these result in an elevated exposure, greater than if it was just one of those chemicals (i.e. vinyl chloride)?

IDPH Cancer Report Comments:

1. pg 21: The occurrence of geographic cluster[s] is explained as occurring in the region because of industry and employment types in the area, which *can* be different from one neighborhood to anotherand that in this way clustering could occur independent of specific environmental factors. I understand that this *concept* is well documented and understood (as evidenced by the liberal use of citations). It does however raise the point.

    a. *Does the industry, employment, and neighborhood dynamic actually differ? It remains a logical explanation, however without a reported investigation into the local dynamics, it can be refuted.*

    b. *More investigations should be made into the environmental conditions in the surrounding communities, as well as if there are elevated impacts on the community's health.*

2. When conducting the Cancer Incidence report, Cook County and Illinois were used as the reference areas for comparison. This led to how expected values could be selected and compared to observed. Statistically, Cook County does account for a large portion of the population in the

State of Illinois (as explained in the study). Scorecard.org lists Cook County, IL as one of the most polluted counties in the nation.

a. *By association then, what possibility is there that you are comparing a polluted community to a polluted county?*

b. The analysis should examine in more detail the adjacent regions/metropolitan areas as well as national rates. This needs to actually show an analysis and go beyond the stating of statistics like1 in 3 people have a lifetime cancer risketc. This analysis could show Crestwood having more or less of an elevated risk but *I think it would be prudent to examine other reference areas and present Crestwoods situation in that way, given the high levels of pollution.*

Additional Questions:

What is the calculated chronic daily intake (CDI) (mg/kg-day) of each chemical that was present at the various sampling points? I want to know the actual concentration values you used in your analyses for DCE-PCE and vinyl chloride, to make the statements that the concentrations were low. What were the specific values? It is also important to know the DCE and PCE values, because I want to see for myself the actual chemical concentrations that were coming out of each resident's taps, over time. I would like to see a range of values for various age groups (children and elderly) as well as, ranges of time for people who would have lived in the area.

If ranges of values were not used, I think it would be prudent to re-evaluate the results. Even if you are hesitant to perform these analyses, think of it as a sensitivity analysis. How is the outcome of the study influenced by changes in certain parameters (ranges of concentrations, CDI, etc)?

IDPH/ATSDR Response

Thank you for your comments and your recognition of the complexities involved in an investigation of this type. Many of your comments pertain to the IDPH Cancer Incidence Report and these have been shared with the IDPH Division of Epidemiologic Studies. Other comments pertain to the environmental investigation and these have been shared with Illinois EPA.

Illinois EPA estimates of the concentration of VOCs in the drinking water during the period from 1985 to 2007 did not exceed federal drinking water standards. Based on the Illinois EPA estimated concentration (1.08 µg/L), no apparent increased cancer risk would be expected. IDPH and ATSDR recognize that the available information does not provide the *actual* levels of chemical contamination that were present in the Crestwood public water system during that time. Still, we would not recommend additional health outcome studies beyond the cancer incidence study conducted and possible the future evaluation of this same area.

Given the low levels of VOCs in the well water and the depth to groundwater, migration of VOCs via soil gas would not be expected to be an exposure pathway of interest. Details about groundwater modeling and sampling to evaluate the dynamics of groundwater were conducted by Illinois EPA and described in several reports on their website

(http://www.epa.state.il.us/community-relations/fact-sheets/crestwood-pws/index.html). The findings of the Illinois EPA groundwater investigation supported the conclusion that pumping of groundwater by the Crestwood Well #1 drew contamination from the Playfield Plaza source area. The investigation also found that VOCs were not detected in the shallow groundwater samples and surface soil samples taken in Playfield Park, indicating that vapor migration was not occurring near the former Crestwood well. IDPH and ATSDR have recommended that an assessment of the potential for subsurface vapor migration into the Playfield Plaza building be conducted. This request has been forwarded to the Illinois Attorney General's office.

IDPH and ATSDR considered the effect of exposure to multiple VOCs would be additive, based on their similar mechanism and target of toxicity. However, there is no evidence that their combined effect would be either synergistic or antagonistic.

Certification

This Crestwood Groundwater Contamination health consultation was prepared by the Illinois Department of Public Health under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It was completed in accordance with approved methodologies and procedures existing at the time the health consultation was initiated. Editorial review was completed by the Cooperative Agreement partner.

Charisse J. Walcott
Technical Project Officer, CAT, CAPEB, DHAC

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

Alan Yarbrough
Team Lead, CAT, CAPEB, DHAC, ATSDR