



Occurrence of Volatile Organic Chemicals in Private Drinking Water Wells in Montgomery County, Pennsylvania

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ABSTRACT

More than 2 million Pennsylvania residents use private wells for drinking water. However, Pennsylvania does not require testing for chemical and biological analytes in private wells, and in addition Pennsylvania is one of four states that lack standards for private well construction and location. For a number of years, legislation has been proposed to regulate private wells in Pennsylvania, but this has been unsuccessful. The United States Geological Survey (USGS) reports that of 2,500 groundwater wells (private and public) sampled for volatile organic compounds (VOCs) across Pennsylvania, 14% had levels that exceeded the respective Maximum Contaminant Levels (MCLs); they also detected VOCs in 65% of the domestic well samples across the U.S. Since 1997, the Montgomery County Health Department (MCHD) has taken a proactive step at the local level by requiring all new private wells be tested for specific water quality parameters including total coliform bacteria, pH, nitrate, numerous VOCs, and as of 2006, total arsenic. Pennsylvania Department of the Environment (PA DEP) and MCHD VOC samples collected from 1982 to 2009 show that 900 of the 1,566 wells (57%) sampled had detectable levels of 28 different VOCs, with 13 different VOCs exceeding their MCLs. After mapping and analyzing this data set, we believe this information further highlights the widespread contamination problems in private wells in Pennsylvania, and the need for required, routine monitoring of private wells to (1) mitigate existing exposures and (2) refer areas of groundwater concern to environmental agencies for further evaluation.

What are VOCs and how do they get in drinking water?

1. Volatile organic compounds (VOCs) are synthetic organic compounds that evaporate readily into the air. VOCs are found in many household, industrial and commercial products such as cleaners, solvents, polishes and degreasers.
2. VOCs can enter groundwater from several sources including underground storage tank leaks, releases from industrial operations, landfills, spills or careless storage and/or disposal around one's home. While some of the spilled or dumped VOCs will evaporate into the air, some portion may soak into the ground. If the VOCs reach the water table, these chemicals may then contaminate drinking water wells. In the U.S., public water systems must monitor for VOCs and meet stringent requirements; however, private well owners are generally responsible for their own well water quality.
3. Health effects including certain cancers, organ damage and blood and nervous system disorders are of concern if exposures to VOCs in drinking water occur at high enough levels.



In Montgomery County, PA it is the builder's responsibility to test the water quality of a new private well

Montgomery County Wells with Detected VOCs

This data set contains data from both PADEP and MCHD. PADEP contributed all monitoring information prior to 1997, in addition to other data generated as part of investigations into identified areas of groundwater contamination. MCHD began requiring all new private wells to be tested for specific water quality parameters in 1997, in addition to collecting monitoring information on some private wells with complaints or concerns.

FULL DATA SET

All of the data from 1982 to 2009 show that 900 of the 1,599 wells (57%) sampled detected levels of 28 different VOCs with 13 at concentrations exceeding their respective MCLs. Overall 340 (22%) of the total well samples had VOC levels above their respective MCLs. Although samples showed non-detect results most frequently (43% of the time), trichloroethylene (TCE) was the most common VOC detected and was found in approximately 31% of the wells sampled for this contaminant. Chlorinated VOCs were the group of chemicals detected most frequently above their MCLs; TCE was found above its MCL approximately 50% of the time it was detected, and PCE was found above its MCL approximately 41% of the time it was detected.

PERMITTED NEW WELLS

Evaluating the data for new well permits only, 7% of these new wells had detected levels of VOCs with 1.8% exceeding their respective MCLs. The most common detections in new permitted wells was TCE. On March 11, 2007 MCHD's arsenic regulations went into effect and the county has since tested all new permitted wells for this contaminant. Of the small subset of new permitted wells which would fall under MCHD's arsenic regulations, 53% of these wells had detectable levels of arsenic with 12% exceeding the arsenic MCL.

Proactive Local Health Monitoring Mitigates Exposures: Rural, Suburban, and Urban Examples in Montgomery County

Baghurst Alley (rural): A re-drill of an existing residential well triggered the need for a new well permit and the county's testing requirements in 1999. TCA was detected at 3,500 ppt and DCE at 1,400 ppm in the private well. Further testing by PADEP in the area revealed 22 homes whose private water supplies were affected by the contamination. The source of the contamination was likely past industrial dumping on a nearby farm property. Efforts to implement public water in the area have not been successful to date, and PADEP continues to maintain carbon filter systems on the affected private wells. Recently 1,4 dioxane began being detected in these wells; this contaminant is not treated by the carbon filter systems. The residents are now also being provided bottled water due to this new concern.

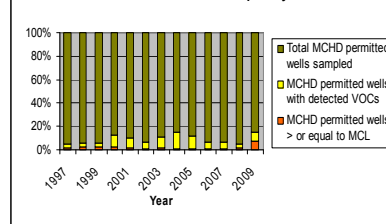


Wolf Run/Farmington Avenue (suburban): In 2003 an existing commercial building needed a new well to replace an old one. Neighbors were also asked if they wanted their wells tested and as a result MCHD found 6 additional private wells with TCE contamination. PADEP then conducted further evaluation of the groundwater contamination in the area. A range of past industrial practices in the area likely produced the contamination, including past car repair and machine shop operations. Approximately 200 residents were subsequently hooked into public water. The township did not pass an ordinance to require abandonment of the private wells in the affected area, unfortunately, so some operating wells with contamination likely still exist in the area.

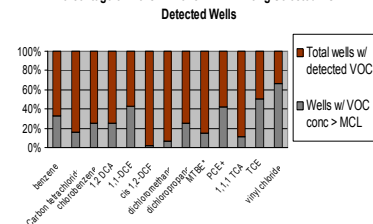
Rahway/East Norriton PCE (urban): A new well permit for new construction in the area resulted in the discovery of PCE contamination in private wells in October 2004, and in November 2004 MCHD issued a health advisory regarding the contamination. PCE is commonly used in dry-cleaning operations. PADEP provided further environmental characterization assistance but state environmental cleanup funds were not available, so federal assistance from EPA and ATSDR was requested. Approximately 67 homes were sampled during the investigation, with a maximum level of 1,120 ppb PCE detected. Bottled water was provided initially, and then public water lines were constructed and made available to the affected residences by 2005/early 2006. The township promulgated an ordinance to abandon the affected wells in spring 2005.

VOC Results in Private Wells from Montgomery County, PA

MCHD Permitted Wells Sampled by Year



Percentage of Wells w/ Conc >MCL Among Selected VOC Detected Wells

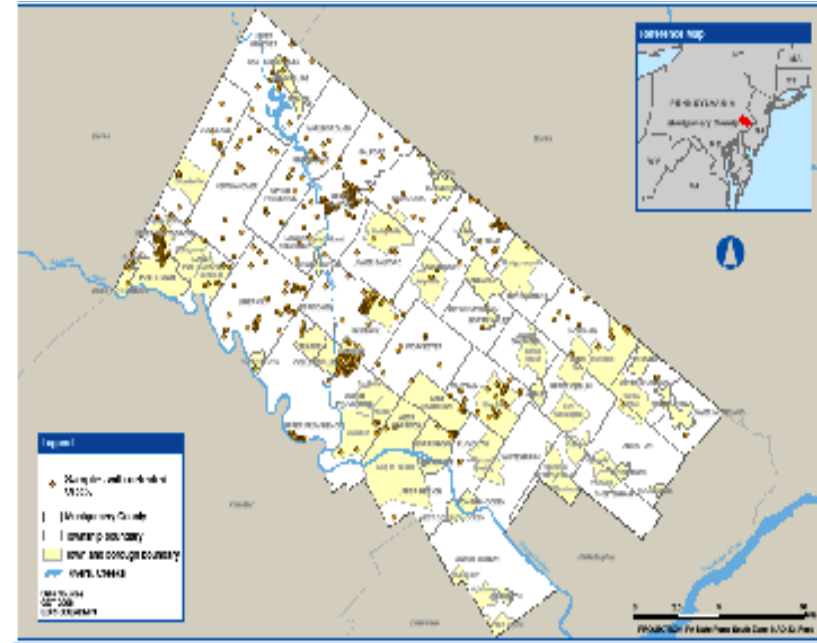


chemical	detections	MCL (ppb)	wells with conc. > MCL
benzene	31	5	10
Carbon tetrachloride	19	5	3
1,2-dichlorobenzene	4	600	0
1,4-dichlorobenzene	5	75	0
chlorobenzene	4	100	1
1,2,4-trichlorobenzene	1	70	0
1,1-DCA	46	N/A	0
1,2-DCA	16	5	4
1,2-dichloroethane	1	5	0
1,1-DCE	158	7	70
cis-1,2-DCE	93	70	2
trans-1,2-DCE	1	100	0
chloroform	9	80	0
chloromethane	2	30	0

* advisory level (no MCL available)

chemical	detections	MCL (ppb)	wells with conc. > MCL
dichloromethane	15	5	1
dichloropropane	4	5	1
dioxane	15	400	0
Ethylbenzene	20	700	0
TTHM	10	80	0
MTBE*	151	20	22
PCE	170	5	71
styrene	7	100	0
1,1,1-TCA	150	200	19
1,1,2-TCA	3	5	0
TCE	478	5	243
toluene	34	1000	0
vinyl chloride	3	2	2
xylene	38	200	0

Private Well Samples with Detected VOCs



Areas in Montgomery County that are blank on the map indicate areas where MCHD does not have monitoring data for the private wells in those locations.

Public Health Conclusions/Recommendations:

- Most private well owners in the U.S. typically do not test their drinking water, and if they do, they commonly only test for a limited subset of parameters such as fecal coliform or nitrates. In a representative survey of 1,015 Montgomery County residents (conducted in 1995 to evaluate support for the proposed well permitting and testing program), less than half of the private well owners indicated they regularly tested their wells and 1 in six private well owners indicated they had never tested their private well.
- This evaluation highlights the frequent contamination of private wells in Montgomery County, particularly with chlorinated VOCs, as well as the identification and mitigation of exposures through a private well permitting and testing program.
- As described in the case studies, contamination has been found in urban, suburban, and rural settings in this region. Collaboration across local, state, and federal public health and environmental agencies is critical to resolving these private drinking water contamination concerns when they occur.
- Even in areas like Montgomery County where new wells are required to be tested, well users still need to be encouraged to monitor existing private drinking water wells. Public health officials need to continue to provide information and resources to private well owners on how to regularly monitor their wells, as well as on what to test for and if contamination is found, how to treat their water.
- Public health officials need to encourage well owners in the areas of the U.S. with no private well monitoring or construction requirements to routinely test their wells. The American Public Health Association and other public health organizations should champion the need for construction and monitoring standards for private wells in Pennsylvania and other parts of the U.S. that are lacking these standards.

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