Health Consultation

PUBLIC HEALTH EVALUATION OF ARSENIC-
CONTAMINATED PRIVATE DRINKING WATER WELLS
IN NORTHEASTERN CONNECTICUT

WOODSTOCK, EAST HAMPTON AND COLCHESTER COUNTIES, CONNECTICUT

JULY 30, 2003

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

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

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

You May Contact ATSDR TOLL FREE at
1-888-42ATSDR
or
Visit our Home Page at: http://www.atsdr.cdc.gov

HEALTH CONSULTATION

PUBLIC HEALTH EVALUATION OF ARSENIC-CONTAMINATED PRIVATE DRINKING WATER WELLS IN NORTHEASTERN CONNECTICUT

WOODSTOCK, EAST HAMPTON AND COLCHESTER COUNTIES, CONNECTICUT

Prepared by:

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

The conclusions and recommendations in this health consultation are based on the data and information made available to the Connecticut Department of Public Health and the Agency for Toxic Substances and Disease Registry. The Connecticut Department of Public Health and the Agency for Toxic Substances and Disease Registry will review additional information when received. The review of additional data could change the conclusions and recommendations listed in this document.

BACKGROUND AND STATEMENT OF ISSUE

Surveys in several New England states have detected elevated arsenic concentrations in drinking water wells. For example, twenty three percent of 990 wells surveyed in New England by the USGS had arsenic in excess of 5 micrograms per liter (Ayotte *et al.*, 1999). Furthermore, bedrock geology and the spatial trend of regional survey data suggest that Northeast Connecticut could also have an arsenic contamination problem. To investigate the occurrence of arsenic in private wells of northeast Connecticut, the Connecticut Department of Public Health, in collaboration with the US Geological Survey (USGS) designed and implemented a survey of private bedrock wells. The purpose of this Consultation is to discuss the pubic health implications of arsenic contamination in Connecticut private bedrock wells based on the results of this recent collaborative effort.

Arsenic contamination in eastern New England

With the introduction of increased monitoring of groundwater supplies in the 1970s, there was a gradual increase in awareness that certain areas of Eastern New England had arsenic contamination in excess of Federal public drinking water standards (i.e., Maximum Contaminant Limit; the MCL.). In particular, areas where arsenic contamination was found in significant amounts are; 1), Southeast New Hampshire, 2), the vicinity of Pepperell Massachusetts, and 3), throughout Maine (Boudette *et al.*, 1985.; Marvinney *et al.*, 1994; Zeuna & Keane, 1985). Because the early studies were not able to identify a man-made source of contamination, it was suspected that contamination was derived from bedrock. While there was sometimes a correlation between a bedrock type and arsenic contamination (Peters et al. 1998, 1999), more often the connection was not clear. Recently however, some insight has been generated through results of studies by Ayotte *et al.*, (1999), who found that bedrock geology can correlate with contamination across a large area. Through an analysis of public bedrock wells in New England (excluding Connecticut), the authors found a spatial correlation with contamination and the occurrence of calcareous metasedimentary bedrock. However, a cross-correlation between contaminated wells in this rock type and pesticide use (deduced from the extent of land used for agricultural purposes) complicates this relationship (Ayotte *et al.*, 1999).

Arsenic contamination in Connecticut

In January 1999, the Connecticut Department of Public Health (CT DPH), under a Cooperative Agreement with the Agency for Toxic Substances and Disease Registry (ATSDR), issued a Health Consultation regarding the Linemaster Switch Corporation Superfund Site (ATSDR, 1999). This publication reported on studies of arsenic contamination in the Town of South Woodstock (the private well study), and in a broader area within the northeast part of the State (the public well study).

Results of the private well study showed that many of the South Woodstock wells in the vicinity of Linemaster Switch contained arsenic. Fifty wells were sampled, and 35 of these had detectable levels of arsenic. This frequency of detects is shown in Table 1. Because the source of the arsenic contamination was not apparent, and because naturally occurring arsenic had been shown to be a problem in other states in the New England region, data from public wells in the region were surveyed based on the hypothesis that the contamination was associated with a particular bedrock type (i.e., The Hebron *[a.k.a. Paxton]* Formation). The Hebron Formation extends Southwest from Woodstock to East Haddam (Attachment A). Data were obtained from over 250 public wells in this region. Results indicate that 18 percent (45/254) of the wells contained detectable levels of arsenic. The level of contamination was generally low. Three percent of the wells surveyed were contaminated with greater than 10 ug/l arsenic [the new federal Maximum Contamination Limit (MCL) for public water]. One well was contaminated with greater than 50 ug/l.

Table 1: Analysis of data from private wells near the Linemaster Switch site (The private well study-see text.). Fifty private water wells in the South Woodstock neighborhood adjacent to the site were sampled for this survey. Thirty-five of these had detectable levels of arsenic. These data are summarized in a previous report (ATSDR, 1999).

Concentration (ug/l)	***Frequency***
Non-detect	16
1 to 5	14
>5 to10	7
>10 to 15	5
>15 to 50	3
>50 to 60	2

Table 2: Analysis of public well data for selected public wells in the Hebron gneiss (The public well study.). Two hundred and fifty four community and non-community public water wells in the northeast region were studied. Forty-five of these had detectable levels of arsenic. These data are summarized in a previous report (ATSDR, 1999).

Concentration (ug/l)	***Frequency***
Non-detect	209
1	10
>1 to 5	21
>5 to 10	6
>10 to 50	7
>50 to 60	1

These previous studies demonstrated that the level of contamination was higher in the South Woodstock neighborhood than compared to the region-wide survey of the public wells.

(Compare 70 percent detects for the private well data to 18 percent for the public well data.) Because the correlation with bedrock was not obvious, and because the source of the arsenic in the private wells was not known to be anthropogenic, the cause of the arsenic contamination in the South Woodstock area was still not known. Further study was therefore needed.

To follow-up on previous reports of contamination in northeast Connecticut, CT DPH considered the available environmental data (discussed above), and consulted with geologists at the USGS, to determine where arsenic contamination is most likely. From this point, USGS scientists took a major role in the design and implementation of this survey.

The survey focused on sampling of domestic bedrock wells along transects in two areas of interest (Attachment B), where (a) elevated concentrations of arsenic have previously been identified in bedrock wells, or (b) bedrock is known to have arsenic-bearing minerals. Bedrock wells were also sampled in adjacent bedrock types that are not expected to contain high arsenic content. Each transect was located within an area of about 20 square miles. Wells were selected to ensure their suitability for obtaining ground-water samples that are representative of the bedrock of interest, and the presence of well log information. Factors including depth and the presence of surface casing were used to select candidate wells. Well owners were then contacted by phone and asked for permission to sample. An onsite examination was done before sampling, as access to a port upstream of the storage tank or treatment systems was required.

Demographics

According to information available from the 1990 census, there are 40,599 housing units in the region (Windham County). Of these, approximately 55.6 percent (22,573 units) do not have public water, and are therefore supplied by private wells. Without extensive survey information, the number of private wells with arsenic in excess of the comparison value (10 micrograms per liter) can not be accurately determined. Still, results discussed in this document suggest that the number of wells with arsenic in excess of the comparison value is relatively small.

COMMUNITY INVOLVEMENT

As mentioned, CTDPH initiated this study in response to concerns expressed throughout the New England region and a knowledge of the results of previous surveys in the Woodstock area. To generate community involvement, representatives of the local health departments in the study region were engaged in this survey, and fact sheets were distributed to well owners. CT DPH staff also met with town officials and survey plans were announced to the community through a local radio station. CTDPH staff also met with some individual well owners during sampling.

DISCUSSION

Private Well Sampling Results

Four of twenty wells in the Colchester-East Hampton transect had detectable levels of arsenic (Detection level was 0.18 ug/l.). Eight of twenty wells in the Woodstock transect had detectable levels of arsenic. The detectable concentrations are shown in Table 3, while the approximate locations of the wells is shown in Attachment B. Except in one instance (well WK212), where there was an obvious degree of sediment associated with the sample, arsenic contamination was not removed by filtration. This suggests that the arsenic is being mobilized (dissolved) by

groundwater. Six of the eight detects from the Woodstock transect were found in the vicinity of the Village of South Woodstock (Southeast corner of Map B, Attachment B). Two of these six wells had concentrations in excess of the comparison value (10 ug/l); 24 ug/l for WK230 and 14 ug/l for WK212.

Table 3. Arsenic was detected in twelve of forty wells sampled along two transects in northeastern Connecticut. Wells from the Woodstock transect are coded with the prefix "WK", while wells from the Colchester/East Hampton transect are coded with the prefix "CO" (see Attachment B). Most detects (i.e., concentrations greater than 0.18 ug/l) were in the northernmost (Woodstock) transect. Two wells sampled in the Woodstock transect contained arsenic in concentrations above the Comparison Value. The Comparison Value is the EPA MCL (10 ug/l)

Location Code*	***Arsenic Concentration (ug/l)***
WK231	0.34
WK221	0.86
WK217	2.9
WK226	4.0
WK227	5.6
WK225	6.0
WK212	14**
WK230	24**
CO346	0.83
CO348	1.2
CO343	2.7
CO344	4.5

* See Attachment B

** Sample exceeds the comparison value (10ug/l)

Health Comparison Value

When determining the public health implications of exposure to hazardous contaminants, CT DPH considers how people might come into contact with contaminants and compares contaminant concentrations with health protective comparison values. When contaminant levels are below comparison values, we can say with relative certainty that health impacts from exposure to those levels are unlikely. When contaminant levels exceed comparison values, it does not mean that health impacts are likely. Rather, it means that exposures should be evaluated further.

The U.S. EPA has recently reassessed the toxicity of ingesting inorganic arsenic and decided that 10 micrograms per liter (i.e., the MCL) represented a practical goal for drinking water. CT DPH concurs with EPA's reasoning, and supports 10 micrograms per liter as a health comparison value.

Exposure pathways

Compared to water from bedrock wells, surface water and groundwater from stratified drift wells are less likely to be contaminated with naturally occurring arsenic because there is less contact between groundwater and bedrock. Contact with bedrock is assumed to be a necessary, but not sufficient condition for leaching of arsenic to occur. Hydrochemical factors that influence the leaching of arsenic from bedrock include pH and redox potential (Brown & Chute, 2002).

The health comparison value (10 ug/l) is based on a total daily drinking water intake of 2 liters. Two liters was used to calculate the daily dose of arsenic because it is an estimate of a level exceeded only 10 percent of the time. Therefore, most people are expected to drink less than 2 liters of well water per day. In people to do drink less than 2 liters of well water per day, the dose of arsenic is proportionateley less.

Drinking water is usually assumed to be the predominant exposure pathway for inorganic arsenic because the arsenic in food is primarily in a different chemical form (i.e.,organic instead of inorganic). This distinction is toxicologically relevant, as the organic forms (e.g., arsenobetaine) do not appear to be harmful to humans (ATSDR, 2000). However, significant amounts of inorganic arsenic may be obtained from food. Depending on assumptions made on how much total arsenic is inorganic (37 percent has been used), exposure from food can be as high as 0.6 to 2.4 ug/kg per day (ATSDR, 2000). Food may thus be a significant source of inorganic arsenic exposure, relative to the ATSDR Minimal Risk Level (MRL) for a dose of inorganic arsenic (0.3 micrograms per kilogram body weight per day). Other, minor, pathways of exposure include air and soil. The amount of inorganic arsenic exposure from these two pathways are considered to small relative to the amount obtained through exposure to drinking water or food (ATSDR, 2000). Exposure via air is low because arsenic is not a volatile chemical, while exposure from soil is low because arsenic does not readily penetrate the skin. Children, in particular, may be exposed to arsenic leached from pressure-treated deck lumber through hand-to-mouth activity. This oral route can be a potentially significant exposure pathway.

Public Health Implications–Adult and Children's Health Considerations

Signs of chronic arsenic toxicity, observed in humans exposed to contaminated drinking water, include dermal lesions, peripheral neuropathy, cancer, and peripheral vascular disease (Blackfoot Disease). In areas of the world where arsenic contamination is endemic (e.g., Bangladesh; see Chowhurdy, 2000), dermal lesions are the most commonly observed symptoms. Results of a study of contamination in rural Taiwan demonstrated a significant association between the level of arsenic in well water and cancers of the liver, nasal cavity, lung, skin, bladder, and kidney (Chen-& Wang 1990). The EPA and The International Agency for Research on Cancer classify arsenic as a known human carcinogen. In a recent analysis of epidemiological results, EPA was not able to determine if any amount of arsenic exposure could be considered safe for a lifetime's

worth of exposure because they were uncertain of how to extrapolate toxicity found at high levels of exposure to levels more commonly encountered (EPA, 2001).

Over the broad area of northeast Connecticut, data from this and previous studies do not indicate that arsenic-contaminated drinking water wells are a widespread public health hazard. Data collected for this and previous studies indicate that some arsenic is present in the southeast quadrant of Woodstock, including the village of South Woodstock. Two wells of eleven sampled in this area had concentrations in excess of the health comparison value. However, because the levels of contamination in the South Woodstock area were not consistently high, and because relatively few wells were sampled, the public health hazard posed by arsenic cannot adequately be determined. Further sampling is therefore justified in the southeast region of Woodstock.

Residents of the homes with concentrations over 10 ug/l could have been exposed to levels of arsenic that may increase their risk of cancer. The actual risk can not be determined because exposure is not known over the long-term and the aforementioned uncertainty regarding the actual carcinogenic potency of inorganic arsenic. However, given that the levels of arsenic in these wells was above the MCL and that arsenic is a known human carcinogen, actions are needed to reduce arsenic exposure to the users of these private wells. Therefore, these well-owners were informed of results of sampling and advised to install a treatment system for the water they drink (see Attachment D).

CONCLUSIONS

1) Data from this and previous studies do not indicate that arsenic-contaminated drinking water wells are a public health hazard over the broad area of northeast Connecticut. However, results justify further sampling in the southeast region of Woodstock because some (mostly below the comparison value) arsenic contamination was detected in bedrock wells.

2) It is uncertain whether bedrock is the source of the arsenic found in the Woodstock wells.

3) ATSDR has a categorization scheme whereby the level of public health hazard at a site is assigned to one of five conclusion categories. ATSDR conclusion categories are included as Attachment C to this report. CT DPH has concluded that arsenic contamination bedrock wells in the northeast region of Connecticut, in general, do not represent a public health hazard. Residents of the homes with concentrations over 10 ug/l could have been exposed to levels of arsenic that may increase their risk of cancer. The actual risk can not be determined because exposure is not known over the long-term, and the aforementioned uncertainty regarding the actual carcinogenic potency of inorganic arsenic. However, given that the levels of arsenic in these wells was above the MCL and that arsenic is a known human carcinogen, actions are needed to reduce arsenic exposure to the users of these private wells; therefore, the levels of arsenic in these wells represent a public health hazard.

RECOMMENDATIONS

For the two wells with arsenic levels above the MCL, actions should be taken to minimize the exposures to users of these wells.

CT DPH recommends that further sampling be done by the Northeast District Department of Health within the southeast quadrant of Woodstock.

PUBLIC HEALTH ACTION PLAN

Actions Taken

1) Scientists from CT DPH, USGS, and the local health department met with officials from the Town of Woodstock to discuss sampling.

2) Individual well sampling reports and fact sheets were sent to well owners along with information on arsenic and how to reduce exposure. Well-owners with arsenic levels above the MCL were advised to install a treatment system for the water they drink. Examples of these documents are attached (Attachment D).

3) CT DPH compiled and distributed a report for the local health departments in the survey area. Results of this study were discussed with the Sanitarian representing the Woodstock area. Representatives of the Northeast District Department of Health agreed to do further sampling of bedrock wells in the southeast quadrant of Woodstock.

4) CT DPH compiled an arsenic fact sheet and distributed it to all local health department and all private water testing laboratories in the State (Attachment D4).

Actions Planned

1) CT DPH will continue to work with the Northeast District Department of Health, all other departments of health in the State, and town officials, in responding to public health concerns and questions.

2) CT DPH will review additional data that may be collected in the future.

3) Information on results of future sampling will be communicated to area residents by the Northeast District Department of Health and CT DPH.

REFERENCES

ATSDR (1999). Investigation of the extent of naturally occurring arsenic contamination in drinking water wells obtaining water from the Paxton geologic formation near the Linemaster Switch Corporation Woodstock, Windham county, Connecticut. Atlanta GA: US Dept. Health and Human Services, Agency for Toxic Substances and Disease Registry.

ATSDR (2000) Toxicological Profile for Arsenic (Update) Atlanta GA: US Dept. Health and Human Services, Agency for Toxic Substances and Disease Registry.

Ayotte, J.D., Nielsen, M.G., Robinson, G.R., Jr., and Moore, R.B., 1999, Relation of arsenic, iron, and manganese in ground water to aquifer type, bedrock lithogeochemistry, and land use in the New England Coastal Basins: U.S. Geological Survey Water Resources Investigations Report 99-4162, 61 p.

Boudette, E.L., Canney, F.C., Cotton, J.E., Davis, R.I., Ficklin, W.H., & Motooka, J.M. (1985). High levels of arsenic in the groundwater of southeastern New Hampshire: A geochemical reconnaissance. US Geological Survey Open File Report #85-202.

Marvinney,R.G., Loiselle, M.C., Hopeck, J.T., Braley, D., & Krueger, J.A. (1994). Arsenic in Maine ground water: an example from Buxton, Maine, in: Proceedings of the 1994 focus conference on eastern regional ground water issues: National Ground Water Association, p. 701-715

Chen, C.J. & Wang, C.J. (1990). Ecological correlation between arsenic level in well water and age-adjusted mortality from malignant neoplasms. *Cancer Res* 50: 5470

Chowdhury et al. (2000). Groundwater arsenic contamination in Bangladesh and West Bengal, India. *Environmental Health Perspectives* 108: 393-397.

Peters, S.C., Blum, J.D., Klaue, B., & Karagas, M.R. (1998). Arsenic occurrence in New Hampshire ground water. Geological Society of America conference, Toronto Canada, October, abstrac # 12653.

Peters, S.C., Blum, J.D., Klaue, B., & Karagas, M.R. (1999). Arsenic occurrence in New Hampshire drinking water. *Environmental Science and Technology* vol. 33 #10.

US EPA (2001). National Primary Drinking Water Regulations; Arsenic and Clarifications to Compliance and New Source Contaminants Monitoring; Final Rule. Federal Register: (40 CFR Parts 9, 141, and 142) January 22, 2001 (Volume 66, Number 14. Page 6975-7066

Zeuna, A.J., & Keane, N.W. (1985). Arsenic contamination of private potable wells, US Environmental Protection Agency National Conference on Environmental Engineering. Northeastern University, Boston Mass

CERTIFICATION

The Health Consultation for private well owners in northeastern 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 health consultation was initiated.

Technical Project Officer, SPS,SSAB,DHAC

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

Chief, SPS, SSAB,DHAC,ATSDR

PREPARER OF HEALTH CONSULTATION

Stewart Chute, PhD.
Toxicologist
Environmental Epidemiology and Occupational Health
Connecticut Department of Public Health

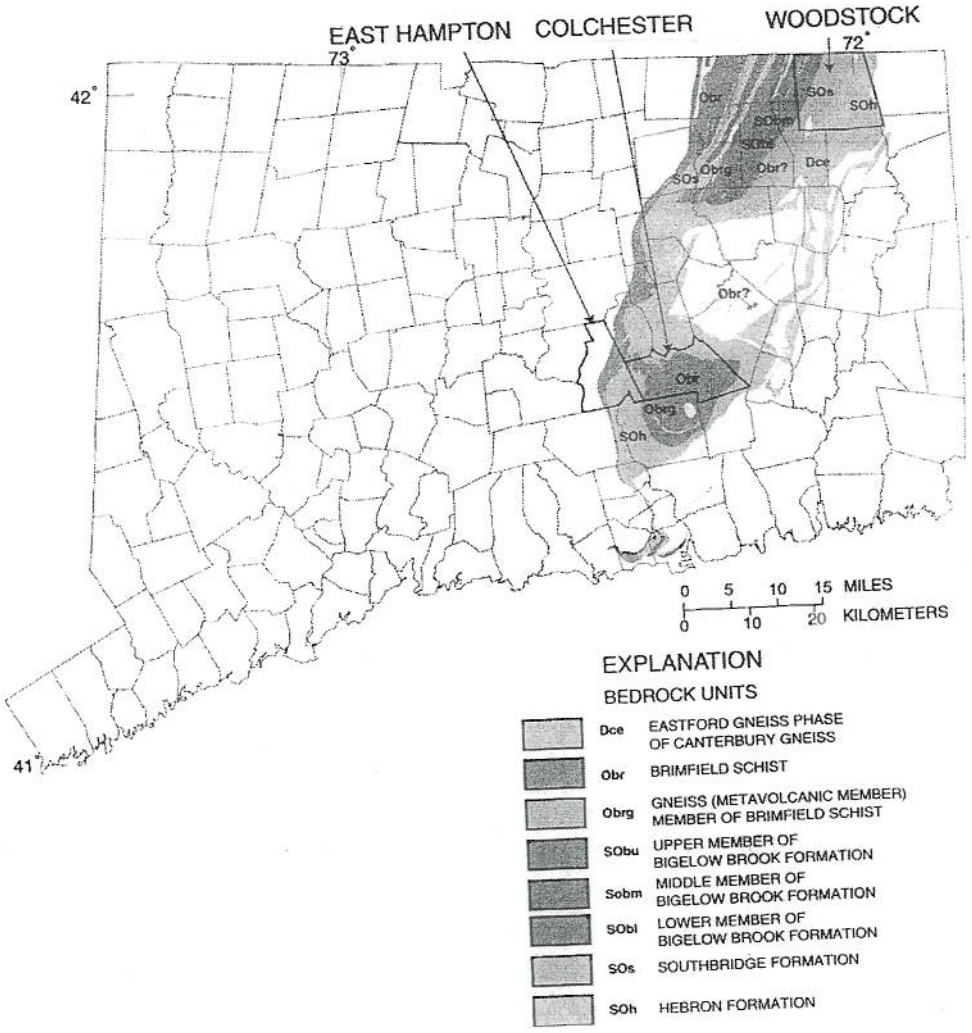
ATSDR Regional Representative:

William Sweet
EPA/New England

ATSDR Technical Project Officer:

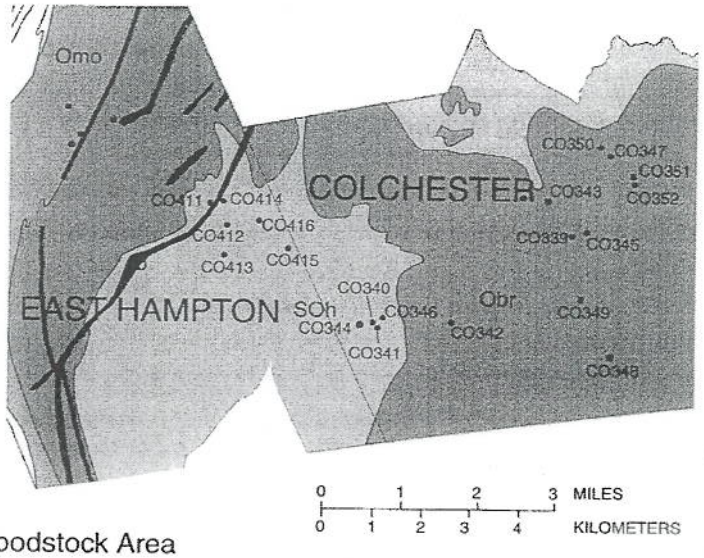
Greg V. Ulirsch
Superfund Site Assessment Branch
Division of Health Assessment and Consultation
Agency for Toxic Substances and Disease Registry

Attachments

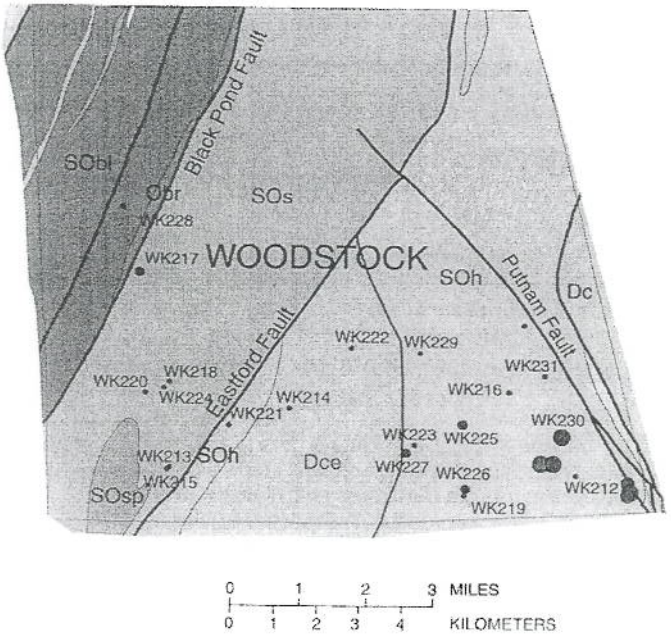


Attachment A: State of Connecticut. Areas surveyed for this study were in the towns of Woodstock, Colchester, and East Hampton. From Brown & Chute (2002)

A. Colchester Area



B. Woodstock Area



Attachment B: Approximate location of survey wells in the Woodstock transect, as indicated by location code. Eight of twenty wells, primarily in the Easternmost portion of the transect, contained dissolved arsenic above the detection limit of 0.18 ug/l. Location codes for arsenic containing wells are listed in Table 3. The Town of South Woodstock, where the highest concentrations were found, is located in the southeast corner of map B. Four in twenty Colchester wells (Part A) had detectable levels of arsenic; the highest of these was 4.5 ug/l. From Brown & Chute, 2002.

Attachment C: ATSDR Public Health Hazard Categories

INTERIM PUBLIC HEALTH HAZARD CATEGORIES

CATEGORY / DEFINITION	DATA SUFFICIENCY	CRITERIA
A. Urgent Public Health Hazard This category is used for sites where short-term exposures (< 1 yr) to hazardous substances or conditions could result in adverse health effects that require rapid intervention.	This determination represents a professional judgement based on critical data which ATSDR has judged sufficient to support a decision. This does not necessarily imply that the available data are complete; in some cases additional data may be required to confirm or further support the decision made.	Evaluation of available relevant information* indicates that site-specific conditions or likely exposures have had, are having, or are likely to have in the future, an adverse impact on human health that requires immediate action or intervention. Such site-specific conditions or exposures may include the presence of serious physical or safety hazards.
B. Public Health Hazard This category is used for sites that pose a public health hazard due to the existence of long-term exposures (> 1 yr) to hazardous substance or conditions that could result in adverse health effects.	This determination represents a professional judgement based on critical data which ATSDR has judged sufficient to support a decision. This does not necessarily imply that the available data are complete; in some cases additional data may be required to confirm or further support the decision made.	Evaluation of available relevant information* suggests that, under site-specific conditions of exposure, long-term exposures to site-specific contaminants (including radionuclides) have had, are having, or are likely to have in the future, an adverse impact on human health that requires one or more public health interventions. Such site-specific exposures may include the presence of serious physical or safety hazards.
C. Indeterminate Public Health Hazard This category is used for sites in which "*critical*" data are *insufficient* with regard to extent of exposure and/or toxicologic properties at estimated exposure levels.	This determination represents a professional judgement that critical data are missing and ATSDR has judged the data are insufficient to support a decision. This does not necessarily imply all data are incomplete; but that some additional data are required to support a decision.	The health assessor must determine, using professional judgement, the "criticality" of such data and the likelihood that the data can be obtained and will be obtained in a timely manner. Where some data are available, even limited data, the health assessor is encouraged to the extent possible to select other hazard categories and to support their decision with clear narrative that explains the limits of the data and the rationale for the decision.
D. No Apparent Public Health Hazard This category is used for sites where human exposure to contaminated media may be occurring, may have occurred in the past, and/or may occur in the future, but the exposure is not expected to cause any adverse health effects.	This determination represents a professional judgement based on critical data which ATSDR considers sufficient to support a decision. This does not necessarily imply that the available data are complete; in some cases additional data may be required to confirm or further support the decision made.	Evaluation of available relevant information* indicates that, under site-specific conditions of exposure, exposures to site-specific contaminants in the past, present, or future are not likely to result in any adverse impact on human health.
E: No Public Health Hazard This category is used for sites that, because of the absence of exposure, do NOT pose a public health hazard.	Sufficient evidence indicates that no human exposures to contaminated media have occurred, none are now occurring, and none are likely to occur in the future	

**Such as environmental and demographic data; health outcome data; exposure data; community health concerns information; toxicologic, medical, and epidemiologic data; monitoring and management plans*

Attachment D1: FACT SHEET FOR SURVEY PARTICIPANTS

Contamination of Private Well Water with Naturally Occurring Arsenic

State of Connecticut Department of Public Health, Division of Environmental Epidemiology & Occupational Health
October, 2000

Surveys in several New England states, including Connecticut, have detected elevated arsenic concentrations in drinking water wells. The arsenic is naturally occurring, and nobody is sure which wells may be contaminated. Because of this uncertainty, and the recent re-assessment of arsenic toxicity by the National Research Council, the Connecticut Department of Public Health and the US Geological Survey, have been conducting a study of arsenic in selected drinking water wells.

Arsenic has no smell or taste. Only water quality testing can determine the presence and concentration of arsenic in well water. Some useful information on arsenic and arsenic testing is included below. For more information call your local health department or the Connecticut Department of Public Health (860-509-7742).

****

WHAT ARE THE POTENTIAL HEALTH EFFECTS OF ARSENIC IN DRINKING WATER?
The Environmental Protection Agency (EPA) and expert scientific committees have classified arsenic as a human cancer-causing agent. Recent research has shown that people living in areas where water concentrations are thought to be the highest in the world (regions of India, Taiwan, and Chile) are more likely to have bladder, lung, or skin cancer. These toxic effects take years to develop.

HOW MUCH ARSENIC IS SAFE TO DRINK?
The Federal government sets safe drinking water standards. In June 2000, EPA proposed lowering the arsenic drinking water standard (MCL) to 0.005[1] milligrams per liter from 0.05. Because this proposed standard is the maximum considered safe for long-term consumption, the Department supports 0.005[1] milligrams per liter as a health-based guideline.

I JUST FOUND OUT I HAVE HIGH ARSENIC LEVELS IN MY WATER: WHAT SHOULD I DO?
If your water has more than .005[1] milligrams per liter arsenic (the EPA-proposed standard), we recommend you consider bottled or treated water to replace tap water for drinking, and cooking. It is safe to wash in arsenic contaminated water because very little arsenic gets into your body through the skin. It is also safe to use the water for other chores (laundry, gardening etc.) because arsenic does not get into the air.

WHAT ARE SOME OTHER SOURCES OF ARSENIC?
On the average, the amount of inorganic arsenic in your food is equivalent to drinking one to two liters of water containing 0.005[1] milligrams per liter arsenic.

IS THERE A WAY TO REMOVE ARSENIC FROM WELL WATER?
Arsenic can be removed with a reverse osmosis type of treatment system. Usually needs can be met by installing a "point of use" treatment system at a convenient location at the kitchen sink, or the

[1]chilled water tap on the refrigerator. Unless there are other water quality problems present, it is sufficient to treat only the water used for drinking and cooking. When looking for treatment solutions, we recommend that you consult with at least two water treatment specialists before deciding on a system (If your water contained more than 0.005[1] mg/l arsenic, a directory of treatment companies will be enclosed.).

IS THERE A MEDICAL TEST THAT WILL TELL ME IF MY BODY HAS TOO MUCH ARSENIC?

No. Although there are tests for urine and hair, results from these tests are difficult to interpret. Therefore, the best way to find out if you are being exposed to excessive amounts of arsenic is to test the well you drink from.

[1] In this fact sheet, CT DPH referred to arsenic concentration was greater than 5 ug/l because, at the time (2000), interim guidance from EPA indicated that the Agency would support 5 ug/l for the arsenic MCL. In the final rule, EPA settled on 10 ug/l for the MCL.

[1]Attachment D2:
Sample letter to well owner with arsenic concentration above 5 ug/l [1]

date

«First_name» «Last_name»
«Street»
«Town» «Zip»

Dear Well Owner,

Please find enclosed a copy of the laboratory analysis results for the samples of drinking water collected on «Sample_Date». Sampling was conducted as part of our investigation of naturally occurring arsenic in your area. Based on the results of this test, you may want to consider installation of a treatment system on the tap that you drink from.

The samples were analyzed by the Department's laboratory for total arsenic. Test results indicate that your drinking water contained «Total_Arsenic_mgl» milligrams per liter (mg/l, or ppm) arsenic. This level is higher than EPA'a proposed limit of .005, but less than the current limit of .050 ppm. Nearby natural mineral deposits are the likely source of the arsenic in your well water.

Because your well water tested high for arsenic, we recommend that you take steps to decrease your exposure to arsenic from your well water. Treatment options include installing a "reverse osmosis" filter or "distiller" on the kitchen tap. We also recommend that you speak with a water treatment specialist. A list of water treatment companies in Connecticut is included. Because purchasing the right filter is important, we have also included information from an independent testing laboratory (NSF) on filters certified to remove arsenic.

Arsenic exposure increases the risk of developing certain kinds of cancer when consumed in very high amounts over long periods of time. Because the amount of arsenic in your water is much lower than in areas where arsenic has caused cancer, the risk for you is uncertain; though likely to be low. However, because conservative estimates suggest that there is some increased risk from drinking water in your range, the prudent thing to do is decrease your exposure to arsenic.

Please read the enclosed fact sheet on arsenic. For further information you may call the Toxic Hazards Section of the Department of Health (860-509-7742).

Thank you,

Brian Toal
Chief
Toxic Hazards Section
Connecticut Department of Public Health

---

[1]In these letters, CT DPH recommended treatment if the arsenic concentration was greater than 5 ug/l because, at the time (2000), interim guidance from EPA indicated that the Agency would support 5 ug/l for the arsenic MCL. In the final rule, EPA settled on 10 ug/l for the MCL.

[1]Attachment D3: Sample letter to well owner with arsenic concentration below 5 ug/l[1]

date

«First_name» «Last_name»
«Street»
«Town» «Zip»

Dear Well Owner,

Please find enclosed a copy of the laboratory analysis results for the samples of drinking water collected on «Sample_Date». Sampling was conducted as part of our investigation of naturally occurring arsenic in your area. Results show that the arsenic concentration in your well water is lower than the Environmental Protection Agency's (EPA) proposed limit. Treatment is therefore not recommended.

The samples were analyzed by the Department's laboratory for total arsenic. Test results indicate that your drinking water contained «Total_Arsenic_mgl» milligrams per liter (mg/l, or ppm) arsenic. This is below the (EPA) proposed drinking water standard of .0051[1] ppm, and below the current standard of .050 ppm.

Arsenic is a carcinogen when consumed in very high amounts over a long period of time. Because your water tested below the proposed standard, your exposure is below the level at which scientists think there may be some justification for concern. We have enclosed a fact sheet on arsenic for your information.

For further information you may call the Toxic Hazards Section of the Department of Health (860-509-7742).

Thank you,

Brian Toal
Chief
Toxic Hazards Section
Connecticut Department of Public Health

---

[1]In these letters, CT DPH refers to arsenic concentration greater than 5 ug/l because, at the time (2000), interim guidance from EPA indicated that the Agency would support 5 ug/l for the arsenic MCL. In the final rule, EPA settled on 10 ug/l for the MCL.

Attachment D4:
This fact sheet was distributed to all local health departments and all water testing labs in the State.

MEMORANDUM

DATE: January 6, 2003

TO: Local Health Directors & Lab Directors

THRU: ML Fleissner, Director; DPH/EEOH

FROM: Stewart Chute, Toxicologist: DPH/EEOH

RE: Arsenic Fact Sheet

Because contamination of private wells with naturally occurring arsenic is a public health issue in other New England States, and because data from Connecticut wells suggested that contamination may also affect Connecticut, the Toxic Hazards Section (in collaboration with the US Geological Survey) conducted a survey of arsenic contamination in selected areas of eastern Connecticut. Eastern Connecticut was targeted in the survey because bedrock types in that part of the state were thought to have the highest potential to be contaminated with arsenic. Results of the survey showed that contamination was not widespread, but concentrations in a few wells (2 out of 40) exceeded the US Environmental Protection Agency's MCL of 0.01 mg/l.

While the results suggest that arsenic contamination is not a significant public health problem in Connecticut private wells (no samples were found in excess of the old MCL of 0.05 mg/l), the survey was limited in scope. Therefore, arsenic contamination may still be a concern for some well owners or homebuyers, and local health departments may be asked about testing for arsenic.

We hope that you will make the enclosed fact sheet available to anyone who wants to know about arsenic contamination. Should you have any questions about the recent survey, or about the public health implications of arsenic contamination, please call me at 860-509-7742.

Contamination of Private Well Water with Naturally Occurring Arsenic

State of Connecticut Department of Public Health, Division of Environmental Epidemiology & Occupational Health

Because arsenic is naturally present in bedrock, and because groundwater in some areas is contaminated with arsenic, surveys of water wells have been conducted in several New England states, including some areas of Connecticut. Results of a recent study conducted by the US Geological Survey (USGS), [1] indicate that some Connecticut bedrock drinking water wells can exceed the Environmental Protection Agency's (EPA) new drinking water standard for arsenic of 0.01 milligrams per liter (mg/l). Though the extent of this contamination is not well known, the number of affected wells is thought to be relatively small.

Arsenic is a metal that has no smell or taste. Only a specific water test can determine the presence and concentration of arsenic in well water. Some useful information on arsenic and arsenic testing is included below. For more information, call your local health department or the Connecticut Department of Public Health (860-509-7742).

****

HOW DOES ARSENIC GET INTO DRINKING WATER & HOW CAN YOU FIND OUT IF YOUR WELL IS CONTAMINATED?

Depending on local environmental conditions, arsenic can leach from soils or mineral deposits into groundwater. However, the extent to which this occurs in Connecticut bedrock wells is uncertain. Surveys in Eastern Connecticut have found that contamination is not widespread, but also, not predictable. Therefore, the only way to know if your well is contaminated is to test the water.

WHAT ARE THE POTENTIAL HEALTH EFFECTS OF ARSENIC IN DRINKING WATER?

The Environmental Protection Agency (EPA) and expert scientific committees have classified arsenic as a human cancer-causing agent. EPA recently lowered the drinking water standard for arsenic because of concerns about possible cancer risks at exposure levels near the old standard. Research indicates that people living in areas where water concentrations are very high are more likely to have bladder, lung, or skin cancer. These toxic effects of arsenic exposure developed after many years of exposure.

Usually, arsenic contamination is measured in units of milligrams per liter (mg/l), which is equivalent to parts per million (ppm). Otherwise, the units may be micrograms per liter (ug/l), which is equivalent to parts per billion (ppb), and 1000 times lower than ppm.

HOW MUCH ARSENIC IS SAFE TO DRINK?

The Federal government sets safe drinking water standards for public water. EPA recently lowered the arsenic drinking water standard (i.e., the Maximum Contaminant Level, or MCL) to 0.01 mg/l. Because this new standard is the maximum considered safe for long-term consumption, the Department of Public Health supports 0.01 mg/l as a health-based guideline for private wells.

WHERE CAN I HAVE MY WELL WATER TESTED FOR ARSENIC?
You can have your water tested at any State-certified water testing lab. A current list of certified labs can be obtained from your local health department, or from the Department of Public Health's web site (http://www.dph.state.ct.us/BRS/Environmental_Lab/instatelablist.htm).

I JUST FOUND OUT I HAVE HIGH ARSENIC LEVELS IN MY WATER: WHAT SHOULD I DO?
If your water has more than 0.01 mg/l arsenic (the EPA public water standard), we recommend you consider bottled or a treatment system to purify tap water for drinking, and cooking. It is safe to wash in arsenic contaminated water because very little arsenic gets into your body through the skin. It is also safe to use the water for other chores (laundry, gardening, etc.) because arsenic does not get into the air.

IS THERE A WAY TO REMOVE ARSENIC FROM WELL WATER?
Arsenic can be removed with a reverse osmosis type of water treatment system, a distiller, or a filter bed of activated alumina. Because it is not necessary to treat all of the water in your house, treatment needs can be met by installing a "point of use" treatment system at a convenient location at the kitchen sink, or the water tap on the refrigerator and icemaker. Information on specific water treatment products is available from the National Sanitation Foundation (NSF) web site at http://www.nsf.org/Certified/DWTU. Staff from The Drinking Water Division of the Department of Public Health (860-509-7333) are also available to answer questions about treatment options.

WHAT ARE SOME OTHER SOURCES OF ARSENIC?
According to results of the Food & Drug Administration's (FDA) total diet study, [2] on the average, the amount of inorganic arsenic in your food is equivalent to drinking one to two liters of water containing 0.005 mg/l of arsenic. Though some types of seafood contain high amounts, the form of arsenic in seafood is not known to be toxic.

IS THERE A MEDICAL TEST THAT WILL TELL ME IF MY BODY HAS TOO MUCH ARSENIC?
Although there are tests for urine and hair, results from these tests are difficult to interpret and, according to the American Medical Association, [3] are unreliable. Therefore, the best way to find out if you are being exposed to excessive amounts of arsenic is to test the well water you drink from.

References:

(1) *Brown, C & Chute S. (2002). Arsenic Concentrations in Bedrock Wells in Colchester, East Hampton, and Woodstock CT. US Geological Survey, Water Investigations Report 02-4135.*
(2) *National Research Council (1999). Arsenic in Drinking Water. National Academy Press, Washington DC. Pp 46-51.*
(3) *Siedel, S., et al. (2001). Assessment of Commercial Laboratories Performing Hair Mineral Analysis. Journal of the American Medical Association: Vol 285, #1, 67-72.*