Letter Health Consultation

WINTERTREE FACILITY

GRAND MARAIS, MINNESOTA

FEBRUARY 25, 2009

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

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LETTER HEALTH CONSULTATION

WINTERTREE FACILITY

GRAND MARAIS, MINNESOTA

Prepared By:

Minnesota Department of Health
Under a cooperative agreement with the
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

9/8/08
Merritt Johnson
Chief of Operations
TERRACE POINT/WINTERTREE
P.O. BOX 1000
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Mr. Johnson,

The purpose of this letter is to discuss water potability, and drinking water data collected at the Wintertree facility in May 2007 and January 2008. The Wintertree units are mostly used as vacation homes for short periods of time. However the occupants can stay for extended periods. The condominiums are approximately 10 miles from the nearest development/town. The only other structures nearby are several homes. The MDH and Minnesota Pollution Control Agency (MPCA) staff met with the property manager and facility co-owner at the condominiums on May 23, 2007. We inspected the plumbing network and carbon filtration equipment in Units 11(A, B) through 15(A, B), and Unit 21. Carbon filtration units were installed the first week of April 2007 to address gasoline range organics (GRO) constituents found in well 720192 that provides water to Units 11(A, B) through 15(A, B), and well 729499 that provides water to unit 19 (A, B) through 21. The source of the GRO is not known, and the concentrations are too high for safe consumption without treatment. Follow-up, confirmatory sampling revealed that GRO concentrations had been effectively decreased below levels of health concern. However, the post-filter samples tested positive for arsenic and aluminum. Arsenic concentrations were a health concern because they were above health based comparison values. Aluminum concentrations affect water palatability and were not a health concern. The pre-carbon filter water samples did not contain arsenic and aluminum. Therefore, these contaminants appeared to be leaching from the filters. A complete exposure pathway for arsenic and aluminum in drinking water was present until the filter units were changed or the contaminants leached out.

Even water with low levels of arsenic may cause harm if it is consumed over a lifetime. Some long-term studies have shown health effects below 100 µg/L, such as skin problems, high blood pressure, and reduced intelligence in children. Sometimes arsenic causes corns (hyperkeratosis) to develop on the palms of the hands, the soles of the feet, and other places on the body. See appendix for a more detailed arsenic toxicity discussion.

It is unknown who was potentially exposed to these contaminants, at what concentration, or for how long. However any exposure that may have occurred would have been brief and intermittent. Although most of the site contaminant concentrations are well below arsenic acute exposure comparison values, unit 21 briefly contained potentially hazardous levels. Fortunately, the levels dropped to non-detect within a month. MDH concludes that short-term acute exposure to the arsenic and aluminum water concentrations is unlikely to cause adverse health effects.

The contaminant leaching filters were replaced in January 2008 with better materials and the post filter treatment arsenic concentrations measured ranged from 1.3 – 6.1 µg/l (see table 1). The Environmental Protection Agency's Maximum Contaminant Limit (MCL) for arsenic in drinking water is 10 µg/l. Furthermore, benzene was not detected in post treatment samples indicating that the GRO contamination was effectively removed.

Table 1 Post-treatment Contaminant Concentrations Measured With New Filters In January 2008.

Contaminant µg/l	Condominium Unit						Criteria µg/l
	11	12	13	14	15	21	
Arsenic	1.6	1.3	1.5	1.8	2.0	6.1	10 (MCL)
Benzene	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	5 (MCL & MDH HRL*)

MCL=U.S. Environmental Protection Agency's Maximum Contaminant Level
* MDH HRL= Minnesota Department of Health's Health Risk Limit

Changing the carbon filtration media addressed the post-filter arsenic, aluminum, and the GRO levels remained below drinking water criteria. The details of the investigation are included in the Appendix .

MDH recommends using carbon units that meet the National Sanitation Foundation NSF/ANSI Standard 61 to avoid the arsenic leaching problems, and National Sanitation Foundation NSF/ANSI Standard 53 for volatile organic compound removal. This will minimized any potential future exposure to contaminated groundwater and filter media.

Sincerely,

Daniel Peña
Environmental Scientist
Minnesota Department of Health

Appendix

Site Investigation

Site Investigation

In May 2007, the MDH and Minnesota Pollution Control Agency (MPCA) staff discussed potential sources for the Gasoline Range Organics (GRO) impacts to the wells at the Wintertree facility and no definitive source was identified. The GRO concentrations are too high for safe consumption without treatment. Carbon filtration is a common remedy for GRO impacted drinking water. However, after carbon filtration units were placed on impacted wells, arsenic and aluminum levels were higher in the filtered water than the unfiltered water. Arsenic levels were compared to the U.S. Environmental Protection Agency (EPA) Maximum Contaminant Level (MCL). Aluminum measurements were compared to EPA Secondary Maximum Contaminant Level (SMCL) a non-regulatory criteria based on aesthetic criteria such as taste, color, and odor.

Plumbing system

In late May 2007 we inspected the plumbing network and carbon filtration equipment in Units 11(A, B) through 15(A, B), and Unit 21. Carbon filtration units were installed the first week of April 2007 to address gasoline range organics (GRO) constituents found in the well 720192 that provides water to Units 11(A, B) through 15(A, B), and well 729499 that provides water to unit 19 (A, B) through 21.

The A units are on ground level and B units are on the lower level. The plumbing equipment for the paired A and B units is located in the B utility room and consists of the following (see Figure 1):

- Individual closed system sub-floor heating systems
- Water softener (shared between units A, and B)
- Separate water heaters
- Separate water meters
- Two carbon filtration units (shared between units A, and B) in series

Following instillation of the carbon filtration units, arsenic concentrations in the filtered water were found to be above the MCL, and higher than the unfiltered water.

Discussion

The MDH staff compared the Wintertree groundwater data results for benzene, toluene, ethylbenzene, and xylenes to Minnesota Health Risk Limits (HRLs), which are promulgated in rule. Results for gasoline range organic (GRO) were compared to Minnesota Health Based Values (HBVs). HBVs are similar to HRLs but are not promulgated criteria. HRLs and HBVs are the concentration of a groundwater contaminant, or a mixture of contaminants, that can be safely consumed daily for a lifetime. These values are expressed as a concentration in micrograms per liter or parts per billion (ppb). The MDH uses HRLs, and HBVs to provide advice to people using private drinking water wells. Because private drinking water supplies are not regulated for contamination, HRLs and HBVs are used to evaluate contaminated wells and provide advice to consumers and well owners about the suitability of their water supply for consumption and other uses. The primary route of exposure is ingestion. Inhalation and dermal absorption are less of a concern. Measurements for arsenic were compared to the EPA's arsenic MCL used as a regulatory standard for public water supplies. Aluminum measurements were compared to EPA Secondary Maximum Contaminant Level (SMCL) a non-regulatory criteria based on aesthetic criteria such as taste, color, and odor. Table 1 summarizes the arsenic and benzene water quality results. Attachment 1 lists all the petroleum, metal and other test results for the Wintertree facility.

GRO consists of numerous organic chemical constituents such as, benzene, ethylbenzene, toluene, and xylenes. Benzene concentrations will usually drive cleanup efforts for gasoline impacted water. Benzene has the potential to cause chromosome aberrations, and there is an increased risk of cancer from a lifetime exposure as levels increase above the HRL. Carbon filtration is a simple and affordable method

used to remove gasoline and all its chemical constituents from groundwater. Note that benzene concentrations dropped below HRLs after installation of carbon units the first week of April 2007 (see Table 1).

Table 1. Wintertree Water Contaminant Summary

Wintertree Water Contaminant Summary					
Unit	Sample Location	Chemical	Sample Result (µg/l)	Sample Date	Criterion Limit* (µg/l)
11A	Bathroom Sink	**Arsenic**	**22**	5/2/07	10 (MCL)
12HB	Hose Bib (pre-filter)	**Benzene** Arsenic	**46** ND	5/2/07	5 (HRL) 10 (MCL)
12A	Bath Sink	Benzene	0.1	5/2/07	5 (HRL)
12A	Bath Sink	Arsenic	6.3	5/2/07	10 (MCL)
12A	Kitchen Sink	Arsenic	ND	5/23/07	
13B	Kitchen Sink	**Benzene**	**31.5**	3/10/07	5 (HRL)
13B	Kitchen Sink	**GRO**	**234**	3/10/07	200 (HBV)
13B	Unknown	**Benzene**	**15**	3/14/07	5 (HRL)
13A	Bath Sink	Benzene	ND	5/2/07	
13A	Bathroom Sink	Arsenic	3.4	5/2/07	10 (MCL)
13A	Bathroom Sink	Arsenic	ND	5/23/07	
13B	Kitchen Sink	**Arsenic**	**20.4**	6/5/07	
14A	Bathroom Sink	**Arsenic**	**51**	5/2/07	10 (MCL)
14B	Pre-filter	Arsenic	ND	5/23/07	
14B	Bathroom Sink	**Arsenic**	**20**	5/23/07	
14A	Kitchen Sink	Arsenic	ND	6/5/07	
14B	Kitchen Sink	Arsenic	ND	6/5/07	
15B	Bathroom Sink (pre-filter)	**Benzene**	**34.7**	3/10/07	5 (HRL)
15A	Bathroom Sink	Benzene	ND	5/2/07	
15A	Bathroom Sink	Arsenic	8.8	5/2/07	10 (MCL)
15B	Pre-filter	Arsenic	ND	5/23/07	
15B	Bathroom Sink	**Arsenic**	**21.9**	5/23/07	
15A	Kitchen Sink	**Arsenic**	**11.4**	6/5/07	
15B	Kitchen Sink	Arsenic	ND	6/5/07	
21	Unknown (post-treatment)	**Arsenic**	**170**	4/9/07	10 (MCL)
21	Unknown (post-treatment)	Aluminum	700	4/9/07	50-200 (SMCL)
21	Hose Bib (pre-treatment)	**Benzene**	**29**	5/2/07	5 (HRL)
21	Laundry Sink	Benzene	ND	5/2/07	
21	Laundry Sink	Arsenic	ND	5/2/07	10 (MCL)
21	Kitchen Sink	Arsenic	ND	6/5/07	

* = Minnesota Health Risk Limits (HRLs), Minnesota Health Based Values (HBVs), Maximum Contaminant Level (MCL), Secondary Maximum Contaminant Level (SMCL)
ND = Not Detected
Bolded values = exceedance of health standard

Even water with low levels of arsenic may cause harm if it is consumed over a lifetime. Sometimes arsenic causes corns (hyperkeratosis) to develop on the palms of the hands, the soles of the feet, and other places on the body. These corns may eventually become skin cancer. Increasing evidence indicates that drinking water containing arsenic at concentrations over100 µg/L for many years may be linked to health problems, including nervous system effects, diabetes, and several circulatory diseases (1). Some studies have shown that, even below 100 µg/L, there may be risk of some health problems, including skin problems, high blood pressure, and reduced intelligence in children. Studies have also linked long term exposure to arsenic in drinking water to increased risk of cancer of the bladder, lungs, liver, and other organs.

It is difficult to pinpoint the exact concentration of arsenic in drinking water that can lead to a particular health problem. Most information about the toxic effects of arsenic comes from groups of people who have consumed water containing naturally occurring arsenic over long periods of time. But even this information is limited; people drink from a variety of water sources and the amount of water a person consumes varies over time. As a result, it is difficult to know one person's exposure to arsenic in drinking water over a period of time. Most cancer researchers have studied people living in areas where arsenic in groundwater is at least several hundred µg/l. However, a growing number of studies show that consumption of water with lower levels of arsenic may be associated with increased risk of health effects. The past exposures to contaminated drinking water at the Wintertree facility are not quantifiable in terms of duration or concentration. How many individuals were exposed is not known. The arsenic contamination was discovered shortly after installing the filter units.

Health effects from exposure to arsenic are related to the amount of arsenic consumed and the duration of exposure. For example, at high concentrations, darkening of the skin (hyperpigmentation) has been reported after just a few months of exposure, but at low concentrations, it takes years to develop. Cancers related to arsenic in drinking water typically do not develop for decades. It is not clear if an exposure that occurs only for a few years early in life can still cause health effects in adulthood, or whether continuous exposure is necessary to result in health effects later. Exposures at Wintertree were very brief.

The aluminum concentrations went from 700 µg/l to non-detect after a month of water use. The EPA secondary aluminum standard (5- 200 µg/l) is based on odor, taste, and color.

Conclusions

All the condominium units have had carbon units installed, to remove petroleum related contaminants, but not all of them were tested for water quality. The groundwater in wells 729499 and 720192 is contaminated with GRO. These wells pose a drinking health hazard if untreated. The number of individuals exposed and their exposure doses are indeterminate. Although the carbon units removed the GRO to safe levels, the drinking water was still a problem due to the presence of elevated arsenic.

The arsenic and aluminum identified in the drinking water samples are not gasoline chemical constituents. MDH advised Wintertree management to sample the water at pre and post carbon treatment locations. The aluminum and arsenic contamination appears to be leaching from the carbon units because the pre-carbon samples did not contain arsenic and the post carbon unit samples did. Unit 21 exceeded the EPA secondary aluminum standard (5- 200 µg/l) for odor, taste, and color. Secondary drinking standards are for esthetic purposes only and are not enforceable. In April 2007, water in Unit 21 contained 700 ug/l of aluminum. In January 2008, after instillation of new carbon, Units 14, 15 and Unit 21 were again tested for aluminum, and none was detected (see Attachment 1 for complete list of drinking water results). Note that the detection limit was at the upper bound of the Secondary drinking standard of 200 µg/l. An aluminum detection limit of 50-100 µg/l is advisable.

Units 11A, 14 (A, and B), 15(A, and B), and 21 contained 22, 51, 20, 11.4, 21.9, and 170 µg/l arsenic respectively in April and May 2007. Drinking water in Units 11A, 14 (A, and B), 15(A, and B), and 21 posed a health hazard if consumed over a long period. Water samples from Units 12(A and B), 13A, also tested positive for arsenic, but were below the arsenic health criterion.

Note that arsenic concentrations appeared to drop with increased water use. For example, unit 21 is the most consistently used (based on Wintertree Management records) and its arsenic level decreased from 170 to non-detect (ND) within a month (see Appendix 1 arsenic results on 4/9/07 and 5/2/07). The arsenic levels in the other units also appear to have decreased in time. However it is not clear how much water is needed to flush the carbon units, and plumbing lines so the water does not exceed the arsenic MCL. Additionally, there is a chance that when a carbon unit is changed and replaced with the improper type of carbon during regular maintenance, the arsenic may spike above the arsenic MCL again.

In January 2008 new carbon was installed and arsenic levels in drinking water were found to be below MCLs.

Recommendations

- MDH recommends that water containing contaminants above, HRLs, HBVs, or MCLs not be used for drinking or cooking. Wintertree post-treatment water containing arsenic concentrations greater than10 µg/l should not be used for drinking or cooking.
- MDH recommends using carbon units that meet the National Sanitation Foundation NSF/ANSI Standard 61 to avoid the arsenic leaching problems, and National Sanitation Foundation NSF/ANSI Standard 53 for volatile organic compound removal. This will minimized any potential future exposure to contaminated groundwater and filter media.

Public Health Action Plan

MDH will consult with the Wintertree management to verify that filtration systems have been updated with better filter media.

Reference

1. Agency for Toxic Substances and Disease Registry Arsenic Toxicological Profile, August 2007.

Wintertree Plumbing System.

Figure 1

Attachment 1

Comprehensive Water Quality Data List

CERTIFICATION

This Wintertree/Terrace Point Health Consultation Letter was prepared by the Minnesota Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was begun. Editorial review was completed by the Cooperative Agreement partner.

Trent LeCoultre
Technical Project Officer, CAT, CAPEB, DHAC, ATSDR

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

Alan Yarbrough
Lead, Cooperative Agreement Team, CAPEB, DHAC, ATSDR