Letter Health Consultation

Earleville Private Groundwater Well Quality

PEARCE CREEK DREDGED MATERIAL CONTAINMENT AREA (DMCA)

CECIL COUNTY, MARYLAND

MAY 27, 2016

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Division of Community Health Investigations
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.

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LETTER HEALTH CONSULTATION

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CECIL COUNTY, MARYLAND

Prepared By:

U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry
Division of Community Health Investigations
Eastern Branch

Agency for Toxic Substances and Disease Registry
Region 3
1650 Arch Street, 3HS00
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May 27, 2016

Frederick C von Staden
Director, Environmental Health
Cecil County Health Department
401 Bow Street
Elkton, MD 21921

Dear Mr. von Staden,

You requested that the Agency for Toxic Substances and Disease Registry (ATSDR) evaluate levels of metals found in residential drinking water wells near the Pearce Creek Dredged Material Containment Area (DMCA) site in Cecil County, Maryland. ATSDR found that some of the levels of manganese detected in private wells in this area could be of public health concern. We are providing this letter to document and explain the scientific basis of our understanding of the public health implications of exposure to manganese in groundwater in the Pearce Creek site area of Cecil County. We also provide recommendations about how to reduce or eliminate exposure. ATSDR will follow up this letter with a full health consultation report containing a comprehensive review of all the chemicals detected in private water wells in this area. As discussed, ATSDR supports all the involved agencies in their actions to (1) inform the public about high levels of metals in private well water; (2) provide public water to private well users in this area of Cecil County, and (3) offer bottled water to these private well users until public water is available.

Manganese is a naturally occurring substance found in many types of rock, soil, groundwater, and food. Several studies have found that mean levels of manganese in public drinking water range from 4 micrograms per liter (ug/L) to 32 ug/L. As reported in the ATSDR Toxicological Profile for Manganese, analyses of the United States Geological Survey (USGS) National Water Quality Assessment (NAWQA) database indicate that the median concentration of manganese was 16 ug/L for surface water and 5 ug/L for groundwater from 20 watersheds and 16 drainage basins in the United States.[1] Regional groundwater quality issues have been identified in the Delmarva Peninsula, which includes the Pearce Creek site area. For example, a USGS report on historical background water quality of the Delmarva Peninsula identified naturally occurring water-quality problems throughout the surficial aquifer in this region, including elevated iron and manganese concentrations and low pH. Additionally, many of the wells in the Delmarva Peninsula did not meet the drinking-water standard or criterion for hardness and nitrate.[2]

ATSDR reviewed the data you provided on treated and untreated water from private drinking water wells in the Pearce Creek area sampled from 1987-2013. The reported manganese water concentrations ranged from less than 50 to 378,000 ug/L. There is variability reported in the manganese levels in the same

[1] Agency for Toxic Substances and Disease Registry (ATSDR). 2012. Toxicological profile for Manganese. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service. Available at: http://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=102&tid=23.

[2] United States Geological Survey (USGS). 1991. Water-Quality Assessment of the Delmarva Peninsula, Delaware, Maryland, and Virginia Analysis of Available Ground-Water-Quality Data Through 1987. Available at: http://pubs.usgs.gov/wsp/2355b/report.pdf.

private wells sampled over time and across the group of private wells sampled in this site area. There are both seasonal and full time residents in this area, which raises uncertainty about exposure durations.

Many of these residential wells (approximately 155) had manganese levels in excess of the EPA secondary maximum contaminant level (SMCL) for manganese in public drinking water supplies of 50 µg/L. ATSDR does not consider exposures to manganese levels at or below the SMCL a public health concern. The manganese SMCL is based on aesthetic water quality parameters and is not a health-based level. Black to brown colored water, black staining, and a bitter metallic taste will be the noticeable effects when manganese levels exceed 50 µg/L.[3] Despite these noticeable water quality effects, studies show that people do drink water containing manganese at levels well above 50 ug/L either because they become accustomed to it and/or they do not have alternative drinking water sources available to them.

The EPA Lifetime Health Advisory (LTHA) for manganese in drinking water is 300 ug/L. According to EPA, this level represents a concentration that is not likely to cause harmful effects over a lifetime of exposure.[4] ATSDR used EPA's LTHA level as a preliminary health-based screening value for the levels of manganese detected in the Pearce Creek area private water wells. The reported concentration of manganese exceeded the EPA LTHA in approximately 115 of the residential wells sampled from 1987 through 2013.

Manganese exposure at an average concentration 793 ug/L has been shown to be associated with reduced full-scale, performance, and verbal raw scores in children in Bangladesh who consumed drinking water with high levels of manganese for 10 years.[5] In a more recent study, Wasserman et al. (2011) reported that manganese exposures >500 ug/L (mean of 725 ug/L) resulted in lower perceptual reasoning and working memory scores after 8 years or more of exposure.[6] Compared to adults, infants and children have higher intestinal absorption of manganese, as well as lower biliary excretion of manganese. Thus, children are especially susceptible to any negative neurotoxic effects of manganese.

For this site-specific evaluation, ATSDR used the scientific literature to develop a Lowest Observed Adverse Effect Level (LOAEL) of 0.07 mg/kg/day to compare with the estimated exposure doses for manganese in drinking water in the Pearce Creek site area. We then used this information to generate a summary table of protective public health recommendations for private well water users for your consideration (see Table 1). ATSDR calculated exposure doses for several age groups (infants, children, adults) to develop these recommendations using age-specific maximum intake assumptions. Although some residents only live in the site area on a seasonal basis, to develop our site-specific recommendations and exposure doses we conservatively assumed that people were drinking the water every day over many years. We summarized the toxicological studies we used to select the 0.07 mg/kg/day LOAEL in Table 2. The three studies investigating manganese exposure in children with neurological endpoints in Table 2 had estimated LOAELs ranging from 0.06 to 0.08 mg/kg/day. ATSDR selected the mid-range LOAEL to use in this evaluation. Based on our evaluation of the available sampling information for private wells

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[3] Environmental Protection Agency (EPA). 2012. Secondary Drinking Water Regulations: Guidance for Nuisance Chemicals. Available at: http://water.epa.gov/drink/contaminants/secondarystandards.cfm

[4] Environmental Protection Agency (EPA) 2012. 2012 Edition of the Drinking Water Standards and Health Advisories. Available at: https://www.epa.gov/dwstandardsregulations/drinking-water-contaminant-human-health-effects-information.

[5] Wasserman GA, Liu X, Parvez F, et al. Water manganese exposure and children's intellectual function in Araihazar, Bangladesh. Environ Health Perspect. 2006;114(1):124-129.

[6] Wasserman, G. A., Liu, X., Parvez, F., Factor-Litvak, P., Ahsan, H., Levy, D., ... Graziano, J. H. (2011). Arsenic and manganese exposure and children's intellectual function. Neurotoxicology, 32(4), 450–457.

from this site area, ATSDR concludes that there may be neurological health concerns for infants and children consuming water with elevated levels of manganese on a daily basis over many years.

Conclusion and Recommendations:

Based on our initial review of manganese concentrations detected in residential wells near the Pearce Creek DMCA site, some private wells have manganese levels of public health concern, particularly for infants and children. ATSDR supports extension of the Cecilton municipal water system to residents near the Pearce Creak DMCA who currently depend on well water for their household water needs, and the provision of bottled water until public water is available. We also note that several other inorganics, including aluminum, iron, sodium, and sulfate, are also present at high levels in some wells; we will evaluate these substances further in our full health consultation to follow.

Until homes in the site area are connected to the municipal water system, ATSDR recommends that:

- All private well owners, wherever they live, test their drinking water on a regular basis.[7]
- Private well users with manganese levels at 300 ug/L or less conduct routine private water well monitoring, including analyses for manganese.
- Private well users with manganese levels at 300 ug/L to 500 ug/L have infants (birth to 1 year) use bottled water or use appropriate and properly maintained water treatment system with bi-annual water quality monitoring.
- Private well users with manganese levels exceeding 500 ug/L have infants and children use bottled water or use appropriate and properly maintained water treatment system with bi-annual water quality monitoring.
- Private well users with manganese levels exceeding 1,000 ug/L use bottled water or appropriate and properly maintained water treatment system with bi-annual water quality monitoring.

If you have any additional questions, feel free to contact me.

Sincerely,

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Mark Mank, Maryland Department of the Environment

[7] Centers for Disease Control and Prevention. Drinking Water, Private Wells, Well Testing. Available online at: http://www.cdc.gov/healthywater/drinking/private/wells/testing.html.

Table 1: General Pearce Creek Public Health Recommendations for Manganese in Drinking Water Summary Table*

Manganese (ug/L)	Recommendation
300 ug/L or less	Routine private water well monitoring, including analyses for manganese.
300 ug/L to 500 ug/L	Infants (birth to 1 year) use bottled water or use appropriate and properly maintained water treatment system with bi-annual water quality monitoring.
>500 ug/L	Infants and children use bottled water or use appropriate and properly maintained water treatment system with bi-annual water quality monitoring.
>1,000 ug/L	All age groups use bottled water or appropriate and properly maintained water treatment system with bi-annual water quality monitoring.

Table 2: Summary of Manganese Drinking Water Studies with Neurological Endpoints Used in the Selection of a LOAEL (mg/kg/day) for Evaluation Purposes

LOAEL	Reference	Population	Exposure Duration (yrs)	Endpoint
0.06	Kondakis 1989[8]	Adult	50	Neurological
0.06	Woolf 2002[9]	Children	5	Neurological
0.07	Wasserman 2006	Children	10	Neurological
0.08	Wasserman 2011	Children	8+	Neurological

[8] Kondakis XG, Makris N, Leotsinidis M, Prinou M, Papapetropoulos T. Possible health effects of high manganese concentration in drinking water. Arch Environ Health. 1989;44(3):175-178.

[9] Woolf, A., Wright, R., Amarasiriwardena, C., & Bellinger, D. (2002). A child with chronic manganese exposure from drinking water. Environmental Health Perspectives, 110(6), 613–616.