Letter Health Consultation

"EVALUATION OF POSSUM POINT WELL WATER"

DUMFRIES, VIRGINIA

Prepared by
Virginia Department of Health

NOVEMBER 3, 2016

Prepared under a Cooperative Agreement with the
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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Under a cooperative agreement with the
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COMMONWEALTH of VIRGINIA
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MARISSA J. LEVINE, MD, MPH
STATE HEALTH COMMISSIONER

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November 3, 2016

Marissa J. Levine, MD, MPH
State Health Commissioner
109 Governor Street
Richmond, VA 23219

Dear Dr. Levine,

The Office of the Commissioner of Health asked that the Virginia Department of Health's (VDH) Division of Environmental Epidemiology (DEE) under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR) review the VDH Office of Environmental Health Services (OEHS) private well results collected near Possum Point Power Station for public health implications. DEE reviewed the results from the private wells sampled near Possum Point Power Station in 2016 and reached six conclusions:

- DEE concludes that the concentration of sulfate in the well water at Residence 1 may harm people's health. Short-term studies suggest that a mild laxative response can occur at sulfate concentrations greater than 500,000 µg/L and the concentration of sulfate in this well was approximately five times higher.
- DEE concludes that the concentration of lead in all well water sample results (Residences 1-7) does not exceed the U.S. Environmental Protections Agency's (EPA) treatment technique level; however, any exposure to lead through ingestion can elevate blood lead levels. The Centers for Disease Control and Prevention (CDC) states that there is no safe level of lead in children's blood. The CDC and ATSDR recommend reducing lead exposure wherever possible, which includes water treatment options that can be used to reduce lead in drinking water.
- DEE concludes that the pH (< 6.5) and sulfate may be contributing to the corrosion of plumbing. Corrosive conditions can result in metal concentrations in tap water that is greater than the concentration in the source water. Also, a low groundwater pH may mobilize metals from the surrounding rock into the groundwater.
- DEE concludes that the concentrations of copper at Residences 1, 2, and 4-7 are not expected to harm people's health, because the health comparison value for adults was

not exceeded at any of these residences. Also, children are not known to reside in the residences where the child comparison value was exceeded (Residences 1, 4, and 5). Residence 3 does not use their well for potable water and is excluded from this conclusion.

- DEE concludes that the concentrations of iron in well water from Residences 1-7 are not expected to harm people's health. The daily source contribution from the well water would have minimal impact on total iron intake. However, people with hemochromatosis or those individuals on an iron restricted diet that use the well water at Residences 5 and 7 should share their well water results with their physician.
- DEE concludes that the concentrations of sodium in well water from Residences 1-7 are not expected to harm people's health. However, people on a sodium restricted diet that use the well water at Residences 1, 2, and 6 should share their well water results with their physician. Residence 3 does not use their well for potable water and is excluded from this conclusion.

There are several limitations that impact these conclusions. Due to the lack of historical well sampling data, it is not possible to assess potential past exposures at these residences. The analytical data represents the concentration of chemicals found in the water sample at the time of sampling and does not necessarily reflect the past or future chemical exposure concentrations. Also, samples taken from an outdoor faucet may not be representative of what the resident would be exposed to if the sample was taken from the drinking water tap, such as the sink faucet (see Table 1). For example, treatment devices placed in line with the drinking water tap can decrease the concentrations of the chemical in the drinking water, but not the outside faucet.

DEE is unable to determine the contribution of Possum Point Power Station coal ash ponds to the chemical concentrations found in nearby private potable wells by the well sample results alone. Field sampling techniques will influence the results, and may introduce further uncertainties. For example, a common sampling approach is to purge water at a tap for >15 minutes, which is expected to evacuate all of the standing water in the well column and plumbing. This is expected to substantially reduce the influence that leaching from metal plumbing and pumps have on the metals concentrations in the water (particularly for lead and copper). If purging is incomplete, the sample will be affected by leaching. If too much water is purged, the sample may be affected by sediment stirred up from the bottom of the well. At Possum Point approximately 40 gallons from the wells were purged prior to collecting a sample (Table 1). Without additional information about well construction, it is not possible to guarantee that a sample collected after a timed purge is directly from the aquifer or from water that has been standing in the plumbing or well column.

Based on the conclusions and limitations presented here and in the discussion section DEE has the following four recommendations:

- DEE recommends that residents on a sodium restricted diet living at Residence 1, 2, or 6 share their well water results with their health care provider.
- DEE recommends that residents on an iron restricted diet living at Residence 5 or 7 share their well water results with their health care provider.

- DEE recommends that residents consider well water treatment options that adjust the pH to recommended levels (6.5-8.5) and reduces sulfates. This will prevent metals from leaching out of pipes which could eventually make residents sick.
- DEE recommends that residents consider treatment options that reduce the lead concentration in their well water.
- DEE recommends that Residence 1 fix the damaged well's casing and lid.

STATEMENT OF THE ISSUES AND BACKGROUND

Possum Point Power Station is a 650-acre steam-electric power station located in Dumfries, VA. The site is located adjacent to the banks of the Potomac River and Quantico Creek in Prince William County. Prior to converting to natural gas in 2003 the facility generated power using two coal fire units and stored the byproduct from burning coal in five onsite water-filled ponds called ash ponds. In 2015, the EPA issued its Coal Combustion Residual Rules calling for the closure of ash ponds across the country. The rules are meant to protect the nation's rivers from ash spills similar to those that happened in Tennessee and North Carolina.

To meet the new closure requirement put forth by the EPA, Dominion Virginia Power is reducing the number of coal ash ponds on site from five to one. The remaining pond will be dewatered, covered with an impermeable system, and topped with two feet of soil and grass. The closure of ash ponds is addressed under two permits, the Virginia Pollutant Discharge Elimination System (VPDES) permit and the solid waste permit. The VPDES permit covers the removal of water from the ponds and the solid waste permit oversees the permanent closure of the dewatered ponds.

There has been much concern by individuals living near Possum Point, environmental groups, and political leaders following EPA's ruling. In June 2015, Virginia State Senators Linda Puller and Scott Surovell requested that drinking water wells for residents living along Possum Point Road near the coal ash ponds be tested to determine if ongoing leaks from the ponds into groundwater had impacted nearby private wells.

In July 2015, the OEHS identified 24 residences within 2,500 feet of the Possum Point coal ash ponds. OEHS sent a letter to each of the 24 property owner in December 2015; only one property owner responded to the letter. OEHS has confirmed that 10 residences out of the 24 within 2,500 feet of the Possum Point coal ash disposal facilities are connected to public water.

In February 2016, OEHS staff attempted to reach each of the property owners by telephone; staff were able to reach fourteen of the owners. A fifteenth property owner contacted VDH in June 2016. Out of those fifteen property owners, nine property owners agreed to have OEHS test their well water. Two of the property owners shared a well, but only one of these owners used the well as their drinking water source. One of the nine property owners that requested a well water sample subsequently connected to the public water supply, therefore a sample was not collected. Between March and June 2016, OEHS collected seven water samples. Only one sample was collected from the shared well; the sample was taken from the residence that uses the well as its source of drinking water. One of the seven water samples was collected from a property that has public water and only uses the well water for washing their car and watering the grass.

Sampling and Results

OEHS staff collected samples pursuant to agency protocols. Samples were collected prior to any water treatment device. A chain of custody was maintained and the water samples were sent to Air, Water, and Soil Laboratories Incorporated, Richmond, VA where they were analyzed for water quality and metals associated with coal ash. A brief sampling overview of each private well is provided in Table 1. The private well samples were tested for 37 water quality characteristics and metals. The results of the private wells sampled are included in the attachment in Table 2.

Table 1. Sampling overview of private wells near Possum Point

Residence	Amount of water purged prior to sampling	Sampling location	Note
Residence 1	44 Gallons	Sillcock outside front of home	Large opening in the top of the well's casing and lid
Residence 2	40 Gallons	Tap located directly above well head in basement	Well located in basement
Residence 3	40 Gallons	Outdoor sillcock	Well not used for potable water for approximately 5 years
Residence 4	40 Gallons	Outdoor sillcock	
Residence 5	40 Gallons	Outdoor sillcock	
Residence 6	20 Gallons	Between pressure tank and the first treatment device	The tap was heavily corroded and cleaned with a paper towel
Residence 7	40 Gallons	Tap located in basement	Hose was attached and used to fill the collection container

DISCUSSION

Pathway analysis

Environmental health professionals use "exposure pathways" to evaluate the specific ways in which people might come into contact with chemicals in the environment. An exposure pathway consists of five elements: a source of contamination, transport through an environmental medium, a point of exposure, a route of human exposure, and an exposed population. Although the coal ash ponds may be a "source" of metals, the plumbing and fixtures at each residence could also be a source of the metals identified in the water samples. Groundwater contaminants may affect the pH which would mobilize lead and copper in the plumbing and fixtures. Also, the transport of metals through the groundwater (environmental medium) can be affected by a number of factors not available for review:

- Groundwater hydrology and geologic composition affect the direction and extent of contaminant transport in groundwater;
- Groundwater depth;
- The physical characteristics of aquifers beneath or near a site, especially the porosity and permeability of their geologic materials, will greatly influence the vertical and lateral movement of groundwater and contaminants;
- Soil characteristics, such as configuration, composition, porosity, permeability, and cation exchange capacity of the soil ultimately influence the rates of percolation, groundwater recharge, contaminant release, and transport; and
- pH of the groundwater, amount of rainfall, minerals present, potential for flooding.

There are also common sampling techniques used to assess contaminants in groundwater:

1. First determining the volume of water that needs to be pumped to purge the entire well volume from the pump to the sample point. This approach will result in backfilling from the aquifer and then the aquifer water will be sampled.

2. Using micropurge techniques, purge slowly while monitoring water quality parameters (conductivity, pH, redox, TDS, and, importantly, temperature). When the parameters begin to stabilize, and the water temp is at expected aquifer concentrations (<14ºC, 55º F, or thereabouts), you can begin sampling because you know the water is coming directly from the aquifer and has not been sitting in the well casing or pipes.

The comparison of the concentration of chemicals in private well water results with ATSDR comparison values (CVs) is one of the first steps in the public health assessment process. The result of this screening step provides an understanding of the priority contaminants at a site. When a contaminant is detected at a concentration less than its respective CVs, exposure is not expected to result in adverse health effects and it is not considered further as part of the public health assessment process. It should be noted that contaminants detected at concentrations that exceed their respective CVs do not necessarily indicate that health effects will occur. Instead, the results of the CV screening identify those contaminants that warrant a more detailed, site-specific evaluation to determine whether health effects are possible.

CVs are chemical and media-specific concentrations in air, soil, and drinking water that are used by ATSDR health assessors and others to identify environmental contaminants at hazardous waste sites that require further evaluation. CVs incorporate assumptions of daily exposure to the chemical and, in the case of soil and water, a standard amount that someone may likely take into their body each day. CVs are non-site specific. They are based on health guidelines with uncertainty or safety factors applied to ensure that they are adequately protective of public health. For this health assessment ATSDR's environmental media evaluation guides (EMEGs), reference dose media evaluation guides (RMEGs), and cancer risk evaluation guides (CREGs) were used to screen contaminants in private wells. For contaminants which there were not ATSDR CVs, EPA's maximum contaminant levels (MCLs), secondary maximum contaminant levels (SMCLs), and life time health advisories (LTHAs) were used. A description of each CV, including EPA's treatment technique for lead is provided in the attachment.

Copper, sodium, and iron exceeded CVs in one or more well (see Table 1, Attachment). Sulfate exceeded its CV in only one well. Although lead did not exceed EPA's treatment technique level the CDC states that there is no safe blood lead level in children. A discussion of copper, sodium, iron, sulfate, and lead as it relates to their finding in potable well water follows.

Copper[1,2]

Copper is a metal that occurs naturally throughout the environment, in rocks, soil, water, and air. Copper is an essential element in plants and animals (including humans), which means it is necessary for us to live. Therefore, plants and animals must absorb some copper from eating, drinking, and breathing. Copper is used to make many different kinds of products like wire, plumbing pipes, and sheet metal. U.S. pennies made before 1982 are made of copper, while those made after 1982 are only coated with copper. Copper is also combined with other metals to make brass and bronze pipes and faucets. Copper compounds are commonly used in agriculture to treat plant diseases like mildew, for water treatment and, as preservatives for wood, leather, and fabrics. Drinking water may have high levels of copper if your house has copper pipes and acidic water. Ingesting high levels of copper can cause nausea, vomiting, and diarrhea. The EPA has determined that copper is not classifiable as to human carcinogenicity. Exposure to high levels of copper will result in the same type of effects in children and adults. We do not know if these effects would occur at the same dose level in children and adults. Studies in animals suggest that young children may have more severe effects than adults, but we don't know if this would also be true in humans. There are a very small percentage of infants and children who are unusually sensitive to copper.

The most likely place to be exposed to copper is through drinking water, especially if the water is corrosive and there are copper pipes in the structure. The best way to lower the level of copper in drinking water is to let the water run for at least 15 seconds before drinking or using it. This reduces the levels of copper in tap water dramatically if the source of copper is the plumbing.

Only the well water at residence 3 exceeded the adult respective health based CV; however, the residents have not used the well for potable water for approximately 5 years.

Iron[3]

Iron is a naturally occurring metal and is the fourth most abundant element in the earth's crust. It is used to manufacture steel which is used in many products. Iron is an essential element that is required for all forms of life. Iron is necessary for the production of red blood cells and the transport of oxygen from the lungs to the tissues. Many foods are fortified with iron and

[1] https://www.atsdr.cdc.gov/substances/toxsubstance.asp?toxid=37 Accessed July 2016.
[2] http://www.cdc.gov/healthywater/drinking/private/wells/disease/copper.html Accessed July 2016.
[3] https://ods.od.nih.gov/factsheets/Iron-HealthProfessional/ Accessed July 2016.

contribute to the daily intake of iron than drinking water. The general population taking iron supplements for an intermediate period of time may experience constipation. There is a rare inherited genetic disease called hemochromatosis which is associated with iron overload in a small percentage of the population. Iron can give water an unpleasant taste, odor, and color. In well-water, iron concentrations below 300 µg/L (microgram/liter) do not affect the aesthetic property of the water. At concentrations above 300 µg/L iron causes a reddish-brown stain on laundry, sinks, porcelain, dishes, utensils, and fixtures. Low pH and corroded pipes and plumbing can contribute to iron already present in well water.

The Food and Drug Administration's reference daily intake for iron is 18 mg (milligram) for adult women. Supplemental iron may cause nausea, constipation, vomiting, and an upset stomach, and accidental ingestion of iron supplements are toxic to children. However, there is not enough iron in any of the samples reported to adversely affect adults or children. If an individual drank water with the highest concentration of iron reported (2,320 µg/L which is 2.32 mg/L) the daily intake from water is estimated to be 4.6 mg/day (2.32 mg/L x 2 L/day = 4.6 mg/day). The daily source contribution of iron would be approximately 25% ((4.6/18) x 100 = 25%). This would have minimal impact on the total iron intake; therefore, for the general population these concentrations of iron are not expected to harm people's health.

Sodium[4]

Sodium is a naturally occurring element in the environment and is the sixth most abundant element on Earth. It is found in soils, plants, water, and foods throughout the world. It is an essential nutrient in the body and is needed for adequate human health. The main source of human exposure to sodium is through the ingestion of sodium chloride (salt) in foods and beverages. The FDA has found that the average American adult consumes between 4,000 and 6,000 mg of dietary sodium per day. The minimum daily requirement for adults and children aged 10+ is 500 mg/day while it is lower for newborns (120 -225 mg/day) and children aged <10 (300-400 mg/day). Requirements do increase during pregnancy and lactation. No optimal sodium intake levels have been established but the American Society of Hypertension and the National Academy of Sciences recommend 2,400 mg/day. Sodium ion exposure can also be attributed to ground and drinking water. The element's solubility in water results in groundwater containing higher concentrations of sodium and minerals than surface water. Sodium chloride is also found in road deicing chemicals, water treatment chemicals, domestic water softeners, and sewage effluents, which contributes to the increased quantities of sodium found in ground water. Although sodium chloride can be found in drinking water, it is not considered a significant exposure route for humans. EPA recommends consulting with your family physician about sodium levels in your drinking water, especially if an individual has sodium-sensitive hypertension. Soil exposure also commonly occurs because the ion naturally occurs on Earth and is an ingredient in fertilizers and agricultural products.

Sodium ion is not known to be carcinogenic but some studies suggest that it can enhance the risk of cancer through other chemicals in the gastrointestinal tract. Acute, high level ingestion of sodium chloride can result in nausea, vomiting, gastrointestinal inflammation, thirst,

[4] U.S. EPA. Drinking Water Advisory: Consumer Acceptability Advice and Health Effects Analysis on Sodium. February 2003.

convulsions, muscular twitching, and in rare cases, death. Long-term, low level ingestion of sodium chloride has resulted in hypertension (elevated blood pressure) in animal studies and is of primary concern regarding oral sodium intake. Infants and children are more susceptible than adults to the effects of acute, high-dose and long-term, low-dose sodium intake due to immature kidneys. Reproductive and developmental effects of high doses of sodium chloride have not yet been studied.

The EPA Drinking Water Advisory (DWA) recommends that sodium concentration in drinking water shouldn't exceed 30,000 to 60,000 µg/L due to the adverse effects on taste. A person's ability to identify sodium in drinking water varies depending on the person's taste threshold at time of intake, age, and health. If public water systems exceed 20,000 µg/L, local and state public health departments must be notified within 3 months of the test.

Sodium concentrations exceeded the SMCL in wells at residences 1, 2, 3, and 6. Residence 3 does not use their well for potable water. Concentrations exceeding the SMCL may affect the taste of the water. This finding should be shared with doctors treating anyone living at residences 1, 2, or 6 with elevated blood pressure.

Sulfate[5,6]

Sulfate is naturally occurring and present in the environment as minerals such as magnesium sulfate (Epsom salt) and calcium sulfate. Some sulfates dissolve readily in water. Sulfates and sulfuric acid are used in the production of fertilizers, chemicals, soaps, fungicides, insecticides, and emetics. They are also used in wood pulp, and mining. Typical sulfate exposure is approximately 500 mg/day with primary exposure being through diet; however, water and air also contribute to total sulfate exposures. Animal and human data from short-term studies suggest that a mild laxative response can occur at sulfate concentrations greater than 500,000 µg/L, especially if there are other osmotically active substances present in the water. In the absence of other osmotically active materials, the laxative effects are unlikely to be observed at concentrations up to about 1,000,000 µg/L sulfate. These effects are exhibited as an increase in stool volume, moisture, and/or increased intestinal transit time rather than frank diarrhea. These effects are not observed for longer term exposures. This may be because of acclimation to sulfate over time. On the basis of animal studies, sulfate does not appear to be a reproductive or a developmental toxicant. Where the water contains high concentrations of total dissolved solids and/or other osmotically active ions, laxative-like effects may occur if the water is mixed with concentrated infant formula or a powdered nutritional supplement. In such situations, an alternate low-mineral-content water source is advised. Infants are more susceptible than adults to diarrheal water loss because of differences in gastrointestinal structure and function. Tolerance to the laxative effect of sulfate has been reported. The taste threshold for sulfate in water is 250,000 µg/L. Sulfate may also contribute to the corrosion of household plumbing. In February 2003, EPA issued a DWA for sulfate, 500,000 µg/L.

[5] U.S. EPA. Drinking Water Advisory: Consumer Acceptability Advice and Health Effects Analysis on Sulfate. February 2003.
[6] World Health Organization. Sulfate in Drinking-water. 2004.

Only the well at Residence 1 had sulfate concentrations that exceeded the DWA. The concentration of sulfate in the sample collected from Residence 1 was 2,310,000 µg/L. This is well over the concentration (500,000 µg/L) that showed a laxative effect. High concentrations of sulfate may affect the aesthetic property of the water, have a laxative effect, and contribute to the corrosion of household plumbing. This residence's well was also reported as damaged with a large opening in the top of the well's casing and lid. This opening may provide a direct path to contaminating the well with sulfate containing products such as fertilizers, fungicides, insecticides and other chemicals.

Lead[7,8]

Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust. Lead can be found in all parts of our environment. Much of it comes from human activities including burning fossil fuels, mining, and manufacturing. Lead has many different uses. It is used in the production of batteries, ammunition, metal products (solder and pipes), and devices to shield X-rays. Because of health concerns, lead from gasoline, paints and ceramic products, caulking, and pipe solder has been dramatically reduced in recent years.

The effects of lead are the same whether it enters the body through breathing or swallowing. Lead can affect almost every organ and system in the body. The main target for lead toxicity is the nervous system, both in adults and children. Long-term exposure of adults can result in decreased performance in some tests that measure functions of the nervous system. It may also cause weakness in fingers, wrists, or ankles. Lead exposure also causes small increases in blood pressure, particularly in middle-aged and older people and can cause anemia. Exposure to high lead levels can severely damage the brain and kidneys in adults or children and ultimately cause death. In pregnant women, high levels of exposure to lead may cause miscarriage. High level exposure in men can damage the organs responsible for sperm production. The Department of Health and Human Services (DHHS) has determined that lead and lead compounds are reasonably anticipated to be human carcinogens, and the EPA has determined that lead is a probable human carcinogen.

Lead rarely occurs naturally in water; it usually gets into the water from the delivery system. Lead does not affect the taste or odor of water. Lead pipes are the main contributor to high lead levels in tap water. Other sources include parts of the water delivery system such as lead solder used to join copper pipes, brass in faucets, coolers, and valves. Although brass usually contains low lead levels, the lead can still dissolve into the water, especially when the fixtures are new. Private wells more than 20 years old may contain lead in the "packer" element that is used to help seal the well above the well screen. Some brands of older submersible pumps used in wells may also contain leaded-brass components. Corrosion of pipes and fixture parts can cause the lead to get into tap water. An acidic pH can cause corrosion of pipes and fixtures. If you have a private well, check both the well and the pump for potential lead sources. A licensed well water contractor can help you determine if any of the well components are a source of lead.

[7] https://www.atsdr.cdc.gov/substances/toxsubstance.asp?toxid=22 Accessed July 2016.
[8] http://www.cdc.gov/healthywater/drinking/private/wells/disease/lead.html Accessed July 2016.

If your water has a lead problem, running or flushing the water that has been standing overnight before drinking or cooking with it will reduce your exposure to lead in the water.[9]

The lead was detected in wells at residences 1, 2, 3, 6, and 7 below the CV. Lead was not detected in wells at residences 4 and 5. Lead is a primary concern for children. CDC states that no safe blood lead level in children has been identified. Even low blood lead levels have been shown to decrease academic achievement, intelligence quotient (IQ), and increase incidence of attention-related and problem behavior. Effects of lead exposure cannot be corrected. CDC and ATSDR recommend reducing lead exposure wherever possible. There are water treatment options that can be used to reduce lead in drinking water such as reverse osmosis, distillation, and carbon filters specially designed to remove lead. Typically these methods are used to treat water at only one faucet.[10]

CHILD HEALTH CONSIDERATIONS

DEE recognizes that children are at a greater risk of developing illness from exposure to hazardous chemicals given their smaller stature and growing body. Although DEE did not identify any children currently living at any of the residences, health-based comparison values derived with additional considerations for children were provided in this health consultation. Children are likely to breathe more air and consume more food and water per body weight than are adults. Also, children's bodies are developing and are susceptible to damage if toxic exposures are high enough during critical growth stages. Finally, children are susceptible to the toxic effects of lead and exposure to lead should be reduced to the extent possible.

LIMITATIONS

There are several limitations that impact these conclusions. Due to the lack of past well sampling data, it is not possible to assess potential past exposures at these residences. Each sample represents the concentration of chemicals found in the well at the time of sampling and does not necessarily reflect the past or future concentration of any chemical. Samples taken from an outdoor faucet may not be representative of what the resident would be exposed to if the sample was taken from the sink faucet. Treatment devices may also further decrease the concentrations of any chemical in the water. DEE is unable to determine the contribution of Possum Point Power Station coal ash ponds to the chemical concentrations found in nearby private potable wells by well sample results alone. Purging the well is expected to remove all the well's standing water thereby eliminating the wells contribution to the metals in the sample. Once purged, the well is recharged with groundwater, and a sample is collected which should be representative of what is in the groundwater, and not influenced by the well structure or plumbing. DEE is not able to determine if the purging method used was appropriate for all wells sampled based on the information provided.

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[9] More information on how to test your water and reduce exposure to lead can be found at EPA's website: https://www.epa.gov/ground-water-and-drinking-water/basic-information-about-lead-drinking-water

[10] NSF website: http://www.nsf.org/consumer-resources/health-and-safety-tips/water-quality-treatment-tips/lead-in-drinking-water last accessed September 2016.

CONCLUSIONS

DEE concludes that the concentration of sulfate in the well water at Residence 1 may harm people's health. Short-term studies suggest that a mild laxative response can occur at sulfate concentrations greater than 500,000 µg/L and the concentration of sulfate in this well was approximately five times higher.

DEE concludes that the concentration of lead in all well water sample results (Residences 1-7) does not exceed EPA's action level; however, any exposure to lead through ingestion can elevate blood lead levels. The CDC states that there is no safe level of lead in children's blood. The CDC and ATSDR recommend reducing lead exposure wherever possible which includes water treatment options that can be used to reduce lead in drinking water.

DEE concludes that the pH (< 6.5) and sulfate may be contributing to the corrosion of plumbing. Corrosive conditions can result in metal concentrations in tap water that is greater than the concentration in the source water. Also, a low groundwater pH may mobilize metals from the surrounding rock into the groundwater.

DEE concludes that the concentrations of copper at Residences 1, 2, and 4-7 are not expected to harm people's health, because the health comparison value for adults was not exceeded at any of these residences. Also, children are not known to reside in the residences where the child comparison value was exceeded (Residences 1, 4, and 5). Residence 3 does not use their well for potable water and is excluded from this conclusion.

DEE concludes that the concentrations of iron in well water from Residences 1-7 are not expected to harm people's health, because the daily source contribution from the well water would have minimal impact on total iron intake. However, people with hemochromatosis or on an iron restricted diet that use the well water at Residences 5 and 7 should share their well water results with their physician.

DEE concludes that the concentrations of sodium in well water from Residences 1-7 are not expected to harm people's health. However, people on a sodium restricted diet that use the well water at Residences 1, 2, and 6 should share their well water results with their physician. Residence 3 does not use their well for potable water and is excluded from this conclusion.

RECOMMENDATIONS

DEE recommends that residents on a sodium restricted diet living at Residence 1, 2, or 6 share their well water se results with their health care provider.

DEE recommends that residents on an iron restricted diet living at Residence 5 or 7 share their well water results with their health care provider.

DEE recommends that residents consider well water treatment options that adjust the pH to recommended levels (6.5-8.5) and reduces sulfates. This will prevent metals from leaching out of pipes which could eventually make you sick.

DEE recommends that residents consider treatment options that reduce the lead concentration in their well water.

DEE recommends that Residence 1 fix the damaged well's casing and lid.

PREPARERS OF THE REPORT

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Attachment

Table 1. Compounds tested in residential well water and their respective comparison values.

Water quality criteria or contaminant	Residential Well (units in µg/L)							Comparison Values (units in µg/L)		
	Residence 1	Residence 2	Residence 3	Residence 4	Residence 5	Residence 6	Residence 7	Child	Adult	Source/Type
Total Alkalinity	N/D	N/D	46,000	N/D	7,500	N/D	20,000	-	-	-
Bicarbonate	N/D	N/D	46,000	N/D	7,500	N/D	20,000	-	-	-
Carbonate	N/D	N/D	N/D	N/D	N/D	N/D	<5,000	-	-	-
Aluminum	N/D	105	N/D	N/D	N/D	129	N/D	10,000	35,000	ATSDR/EMEG
Antimony	N/D	N/D	N/D	N/D	N/D	N/D	N/D	4	14	ATSDR/RMEG
Arsenic	N/D	N/D	N/D	N/D	N/D	N/D	N/D	0.0230	0.0230	ATSDR/CREG
Barium	88	127	52	114	18	178	37.7	2,000	7,000	ATSDR/EMEG
Beryllium	N/D	1	N/D	N/D	N/D	1	N/D	20	70	ATSDR/EMEG
Boron	N/D	71	N/D	N/D	N/D	66	N/D	2,000	7,000	ATSDR/RMEG
Cadmium	N/D	N/D	N/D	N/D	N/D	N/D	N/D	1	3.5	ATSDR/EMEG
Calcium	9,660	6,410	25,300	5,870	4,620	14,600	2,730	N/A	N/A	-
Chloride	35,900	39,600	48,700	15,400	3,500	96,700	4,200	250,000	250,000	EPA/SMCL
Chromium (Total)	1.00	N/D	N/D	N/D	N/D	1.39	N/D	100	100	EPA/MCL
Chromium 6	N/D	N/D	N/D	N/D	N/D	5.00	8.0	9	32	ATSDR/EMEG
Cobalt	N/D	11.70	7.60	9.00	N/D	30	N/D	100	350	ATSDR/ EMEG(I)
Copper	**341**	N/D	**644**	**313**	**109**	27	62	100	350	ATSDR/ EMEG(I)
Iron	35	53	112	N/D	**1,650**	70	**2,320**	300	300	EPA/SMCL
Lead	10	3.00	1.60	N/D	N/D	2.77	4.21	15	15	EPA/TT
Lithium	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/A	N/A	-
Magnesium	4,740	3,890	5,120	3,730	1,670	10,200	1,390	N/A	N/A	-
Manganese	36	74	N/D	14	34	60	47.4	300	300	EPA/LTHA
Mercury	N/D	N/D	N/D	N/D	N/D	N/D	N/D	2	2	EPA/MCL
Molybdenum	N/D	N/D	N/D	N/D	N/D	N/D	N/D	50	180	ATSDR/RMEG
Nickel	N/D	13	N/D	N/D	N/D	21	N/D	200	700	ATSDR/RMEG

Water quality criteria or contaminant	Residential Well (units in µg/L)							Comparison Values (units in µg/L)		
	Residence 1	Residence 2	Residence 3	Residence 4	Residence 5	Residence 6	Residence 7	Child	Adult	Source/Type
Potassium	4,590	1,990	5,730	4,120	3,810	6,380	3,230	N/A	N/A	-
Alpha Radium‡	0.427	1.090	0.398	1.050	0.111	1.580	0.348	15	15	EPA/MCL
Radium 228‡	1.730	0.541	0.117	1.440	-0.020	2.010	0.477	5	5	EPA/MCL
Combined Radium‡	2.160	1.640	0.515	2.500	0.091	3.600	0.826	5	5	EPA/MCL
Selenium	N/D	N/D	N/D	N/D	N/D	N/D	N/D	50	180	ATSDR/EMEG
Sodium	**20,200**	**25,700**	**22,800**	7,630	2,930	**25,900**	2,130	20,000	20,000	EPA/SMCL
Strontium	57	39	130	41	35	110	16	6,000	21,000	ATSDR/RMEG
Sulfate	**2,310,000**	18,000	31,000	6,100	5,600	23,200	6,400	500,000	500,000	EPA/DWA
Thallium	N/D	N/D	N/D	N/D	N/D	N/D	N/D	2	2	EPA/MCL
Thorium	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/A	N/A	-
TDS	183,000	138,000	244,000	110,000	115,000	251,000	114,000	500,000	500,000	EPA/SMCL
Vanadium	N/D	N/D	N/D	N/D	N/D	N/D	N/D	100	350	ATSDR/ EMEG(I)
Zinc	71	36	105	16	12	101	30.5	3,000	11,000	ATSDR/EMEG
pH†	4.85	5.2	5.79	4.78	5.42	4.86	5.4	6.5-8.5	6.5-8.5	EPA/SMCL

Bolded values=exceedance of CV. µg/L – micrograms per liter. N/D – not detected. ATSDR – Agency for Toxic Substances and Disease Registry. EMEG – environmental media evaluation guideline, chronic unless otherwise specified. EMEG(I) – EMEG intermediate. RMEG – reference media evaluation guideline. CREG – cancer risk evaluation guideline. EPA – Environmental Protection Agency. SMCL – secondary maximum contaminant level. MCL – maximum contaminant level. TT – treatment technique. DWA – drinking water advisory. LTHA – lifetime health advisory. TDS – total dissolved solids.

†The analysis for pH is unofficial due to extremely short holding times according to the reporting laboratory.

‡ Units are pCi/L.

Comparison Values

Environmental Media Evaluation Guides

Environmental Media Evaluation Guides (EMEGs) represent concentrations of substances in water to which humans may be exposed during a specified period of time (acute, intermediate or chronic) without experiencing non-cancerous adverse health effects. EMEGs have been calculated using minimum risk levels (MRLs) and default exposure assumptions. The default exposure assumptions account for variations in water ingestion between adults and children.

Reference Dose Media Evaluation Guides

ATSDR develops Reference Dose Media Evaluation Guides (RMEGs) for drinking water using EPA's reference doses (RfDs) and default exposure assumptions. Like EMEGs, RMEGs represent concentrations in water to which humans may be exposed without experiencing non-cancerous, adverse health effects. RfDs consider lifetime exposures; therefore, RMEGs apply to chronic exposures.

Cancer Risk Evaluation Guides

Cancer Risk Evaluation Guides (CREGs) are media-specific comparison values that are used to identify concentrations of cancer-causing substances that are unlikely to result in a significant increase of cancer rates in an exposed population. ATSDR develops CREGs using EPA's cancer slope factor (CSF) or inhalation unit risk (IUR), a target risk level (10^{-6}), and default exposure assumptions. The target risk level of 10^{-6} represents an estimated risk of 1 excess cancer cases in an exposed population of 1 million.

Maximum Contaminant Levels

Maximum Contaminant Levels (MCLs) are established by the EPA and are enforceable standards under the Safe Drinking Water Act. MCLs are the highest level of a contaminant that is allowed in drinking water. MCLs are set as close to Maximum Contaminant Level Goals (MCLGs) as feasible using the best available treatment technology and taking cost into consideration. An MCLG is the maximum level of a contaminant in drinking water at which no known or anticipated adverse effect on the health of persons would occur, allowing an adequate margin of safety. MCLGs are based on an individual consuming two liters of water daily over a lifetime.

Secondary Maximum Contaminant Levels

The EPA has developed secondary maximum contaminant levels (SMCLs) for substances that, at high levels, can cause unpleasant characteristics in drinking water. These SMCLs are based solely on aesthetic considerations (taste, color, staining, etc.), and generally have no implications for human health.

Health and Drinking Water Advisories

Health advisories (HAs) provide information on contaminants that can cause human health effects and are known or anticipated to occur in drinking water. EPA's HAs are non-enforceable and provide technical guidance to states agencies and other public health officials on health effects, analytical methodologies, and treatment technologies associated with drinking water contamination. The tables contain HA values for certain contaminants based on non-cancer health effects for different durations of exposure (for example, one-day, ten-day, and lifetime). DEE used the lifetime health advisory (LTHA) when other CVs were not available. A DWA is not an enforceable standard for action. However, it describes non-regulatory concentrations of the contaminant in water that are expected to be without adverse effects on both health and esthetics. Both HA and DWA serve as informal technical guidance to assist Federal, State and local officials responsible for protecting public health when emergency spills or contamination situations occur. They are not to be construed as legally enforceable Federal standards. They are subject to change as new information becomes available.

Treatment Technique (Lead)

Lead levels in water work systems are regulated by a treatment technique level that requires systems to control the corrosiveness of their water. If more than 10 percent of tap water samples exceed the action level, water systems must take additional steps. For lead, the EPA action level is 15 µg/L.