Introduction

Arsenic, specifically inorganic arsenic, is classified by the International Agency for Research on Cancer as a group 1 carcinogen. The U.S. Environmental Protection Agency (EPA) has also acknowledged that arsenic causes cancer. It is number one on the Center for Disease Control and Prevention’s (CDC) list of the top 10 preventable causes of cancer. The U.S. Environmental Protection Agency (EPA) recently completed a review of National Health and Nutrition Examination Survey (NHANES) data. Four out of every 10,000 Americans are estimated to be exposed to toxic levels of arsenic in drinking water. The EPA limits arsenic in water to 10 parts per billion (ppb) (or 10 µg/L), and in New Hampshire an estimated 41,000 individuals drink private well water that exceeds the EPA limit of 10 ppb. Arsenic is the number one contaminant on the Center for Disease Control and Prevention’s list of top 10 preventable cancer causes. Arsenic is linked to lung and bladder cancer rates in Northern New England. Low-to-moderate levels of arsenic in drinking water were associated with an increased risk of bladder cancer. Bladder cancer is the third most diagnosed cancer in New Hampshire and ranks 8 in New Hampshire’s cancer mortality. Squamous Cell Carcinoma (SCC), a type of skin cancer, has long been associated with high-dose arsenic exposure. A 2013 population-based study in New Hampshire found that low-dose exposure of arsenic also is linked to SCC. High-dose arsenic exposure is also linked to lung cancer. A 2011 study in the U.S., looking at soil arsenic concentrations and lung cancer, found a significant association between the two, and it was estimated that arsenic may contribute to up to 5,297 cases of lung cancer per year. In 2000, the U.S. EPA’s maximum contaminant level (MCL) for arsenic in public water systems was 50 ppb. At one time, the U.S. EPA estimated that the excess population risk of lung and bladder cancer at water concentrations of 50 ppb was 1 in 100 to 1 in 300. In 2003, the U.S. EPA lowered the MCL to 10 ppb, giving public water system operators until 2006 to meet the change. Researchers at Columbia University recently completed a review of National Health and Nutrition Examination Survey data looking at trends of urinary arsenic concentrations in public water users vs. private well users after the US EPA’s lowering of the MCL. They found a reduction in urinary arsenic among public water users, estimating a reduction of 200-300 µg/L and bladder cases annually depending on the
When arsenic exposure via drinking water at levels over 10 ppb is not a concern, detecting the presence of arsenic is the initial stage of arsenic exposure. Both inorganic and organic arsenic are found in food, including rice, prawns, fruits, and seafood. However, it is estimated that there are six different chemical forms of arsenic in food, and they vary widely in their effects on human health. Some are considered completely safe and some are highly toxic. Rice and seafood are the main sources of dietary arsenic exposure. Rice is a staple food eaten by half of the global population, and rice can have a 10-fold higher inorganic arsenic level than other grains.

In the United States, there are currently no regulations for dietary arsenic. In 2013, the Food and Drug Administration (FDA) proposed an ‘action level’ for arsenic in apple juice at 10 ppb; the same is recommended for public water systems. In 2016 the FDA proposed a limit of 100 ppb for inorganic arsenic in infant rice cereal. While the FDA’s risk assessment found lung and bladder cancer risk from lifetime exposure to rice and rice products to be relatively small, many also suggested that the risk increases almost proportionately with increases in exposure. These limits were proposed for a variety of reasons, including enforcement considerations and the ability to produce food for infants and young children at 10 ppb – matching the FDA’s proposed limit. Studies on human exposures following this legislation indicate that it has been ineffective to date.

Arsenic and Private Wells in New Hampshire

In the U.S., 95% of private water supplies contain more than 10 ppb of arsenic. Approximately 46% of New Hampshire residents (more than 500,000 people) depend on private wells for their drinking water. As many as 46,000 drinking water sources exceed 10 ppb of arsenic. Public water supplies are regulated, tested, and treated to meet maximum contaminant levels, but private wells have no such requirements. It is the responsibility of the well owner to test, treat, and maintain the quality of their private water supply. When some residents prioritize the monitoring of their well water, many do so inconsistently or not at all. A 2014 survey found 64.2% of private well owners in New Hampshire reported having their wells tested for arsenic within the last 3 years. In a random sampling of bedrock wells in southeastern New Hampshire, nearly one-fifth tested contained arsenic levels that exceed the EPA’s MCL of 10 ppb. In Rockingham, Strafford, and Hillsborough counties, it’s estimated that private drinking water supplies for more than 41,000 people may have arsenic above 10 ppb.

Ideally, private well owners should test their wells every 3-5 years. The New Hampshire Public Health Lab, housed within the New Hampshire Department of Health and Human Services, offers water testing, as do eight private, certified laboratories located across the state. Despite how intimidating and complex arsenic testing is, it is the responsibility of the public health professionals. If well water requires treatment for elevated arsenic, there is a variety of options for New Hampshire residents. The New Hampshire Department of Environmental Services has an online application, called Be Well Informed, to help individuals understand their water test results and identify what treatment technologies may work best for them. Other short-term options, like switching to bottled water, using an alternative water source, or using a pitcher filter certified for arsenic removal, can also help until a more permanent solution has been found.

Arsenic in food, with a focus on rice and rice products in New Hampshire

Understanding dietary arsenic exposure is a complicated, ever-changing undertaking. Although consumption of arsenic-containing food, such as rice, is low in the U.S., there are populations who consume more foods that are higher in inorganic arsenic. Individuals with dietary restrictions (e.g., following a gluten-free diet), weaning infants, or people following traditional Asian or Hispanic diets may consume rice multiple times a day. A 2016 study of New Hampshire Birth Cohort participants found that the intake of rice and rice products was associated with inorganic arsenic exposure in infants and suggested that every effort should be made to reduce arsenic exposure during this important phase of development. Given the prevalence of arsenic in well water in New Hampshire, some members of these groups will also be exposed to arsenic via drinking water. To reduce arsenic exposure via food, the Dartmouth Toxic Metals Superfund Research Program suggests including a variety of grains in the diet; cooking rice in large amounts of water; eating basmati rice from India, Pakistan, or California; or eating sushi rice. Since rice is a very common ingredient in many foods, especially gluten-free foods, people should also check their processed foods for rice as a main ingredient and limit consumption accordingly. In New Hampshire, arsenic exposure via contaminated drinking water or food happens every day. Clinical and public health professionals are vital to reducing arsenic exposure. Let them know like testing well water or eating a varied diet, can make a real difference. Working together, we can lower New Hampshire residents’ risk of arsenic exposure and the negative health effects associated with exposure over time.

References: