



# PRIVATE WELLS IN NH

**MAKING WATER TESTING &  
TREATMENT A PRIORITY**

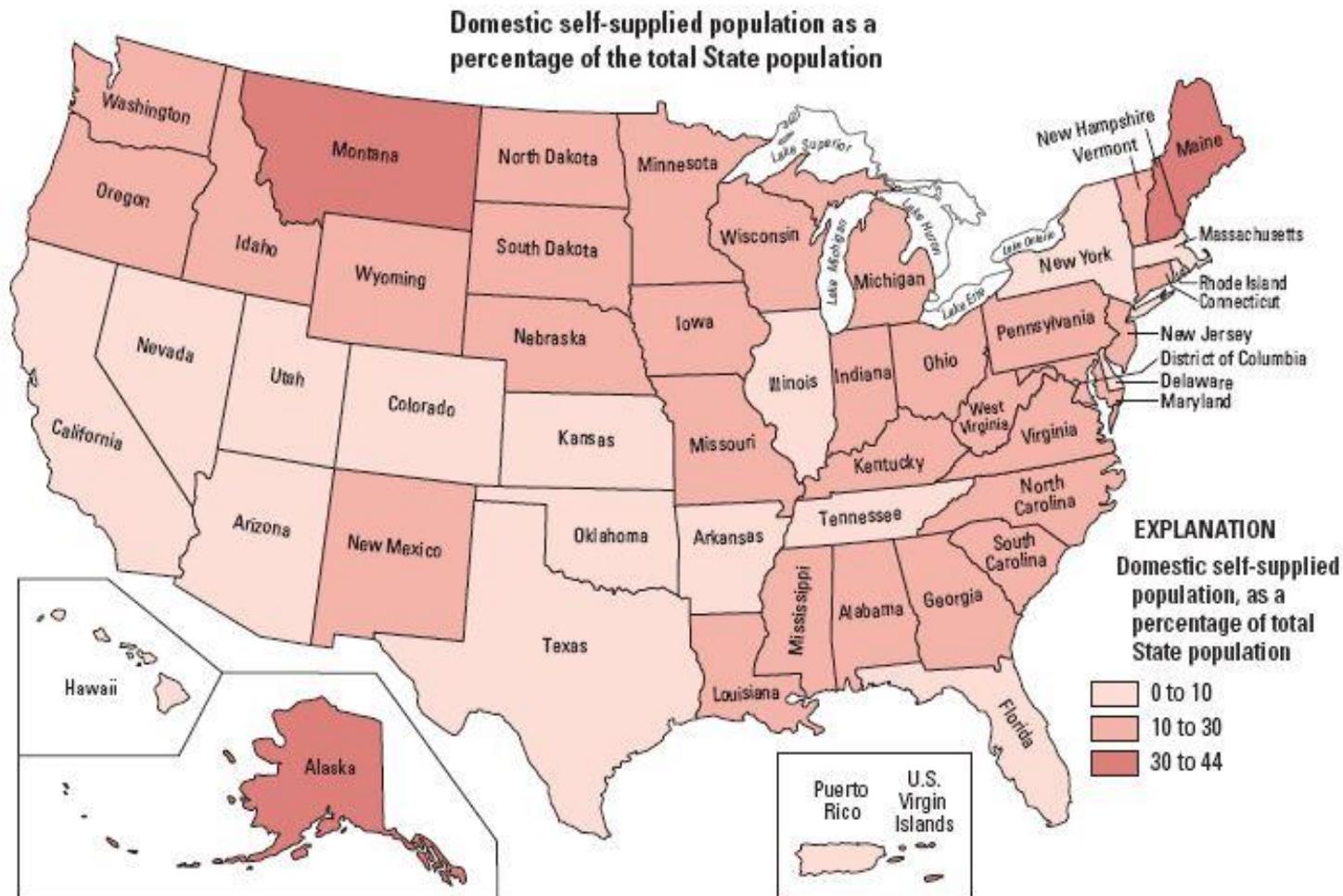


# Private Wells in NH

- Key Messages:
  - Regulation of private wells is left to states and towns
  - NH has no statewide requirements to test/treat private well water
  - Test, and if necessary treat your drinking water so it is safe for consumption



# 36-40% of NH homes obtain drinking water from private wells



Contaminant	Type	Human-health benchmark		Potential health effects from exposure above benchmark	Source of contaminant in drinking water
		Value	Type		
Arsenic	Trace element	10 µg/L	MCL	Increased risk of several cancers; circulatory problems; endocrine disruption	Erosion of natural deposits; runoff from historic pesticide or insecticide application; some industrial waste
Lead	Trace element / Heavy metal	15 µg/L	EPA Action Level	Developmental delays; children could show slight deficits in attention span and learning abilities Adults: Kidney problems; high blood pressure	Corrosion of household plumbing; erosion of natural deposits
Radon	Radionuclide	4,000 pCi/L	EPA Action Level	Increased risk of lung cancer for radon in air; slight increase in risk of stomach cancer for radon in water	Radioactive decay of uranium in aquifer; building materials
		300 pCi/L	EPA Proposed MCL		
Manganese	Trace element	300 µg/L	USGS HBSL	Neurological effects; manganism Some evidence that shower inhalation can cause toxicity	Soil; aquifers; gasoline
		.05 mg/L	EPA SMCL		
Uranium	Trace element	30 µg/L	MCL	Increased risk of cancer; kidney toxicity	Aquifers
Nitrate/Nitrite	Organic/Inorganic Compounds	10 mg/L	MCL	Shortness of breath; blue baby syndrome; Methemoglobinemia	Fertilizer use; manure; sewage and septic-system effluent; aquifer materials
E. coli; Legionella; Giardia; Cryptosporidium	Microorganisms	Goal: zero		Gastrointestinal illness (diarrhea; vomiting; cramps); Legionnaire's Disease	Human and animal fecal waste; some are naturally present
MtBE	Fuel oxygenate	13 µg/L	NH DES Health-based	Possible carcinogen; not well studied, but stomach irritation, liver and kidney damage in animals	Leaking storage tanks and pipelines; gasoline spills; air deposition

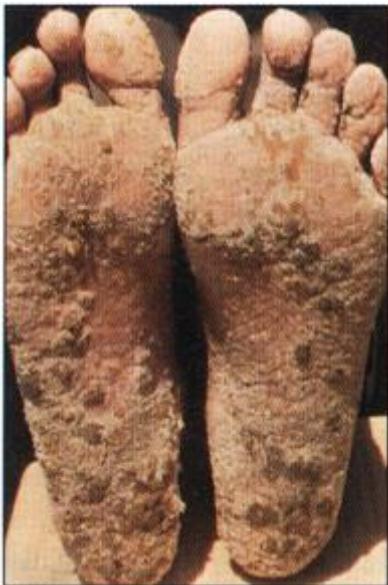
# What is arsenic?

- Colorless, odorless, and tasteless chemical element
  - A metalloid
  - As is present naturally and as a result of human activities
  - Industrial use is declining, but used historically as a:
    - Agricultural insecticide and herbicide
    - Feed additive
    - Wood preservative (phased out)

The image shows a standard periodic table of elements. The elements are arranged in seven horizontal rows (periods) and 18 vertical columns (groups). The groups are color-coded: Groups 1-2 (alkali metals and alkaline earth metals) are yellow; Groups 13-18 (transition metals, lanthanides, and actinides) are purple; and Groups 19-36 (post-transition metals) are blue. The table includes atomic numbers, element names, and symbols. To the right of the table, the text "Periodic Table of the Elements" is displayed in large, bold, black letters.

# Periodic Table of the Elements

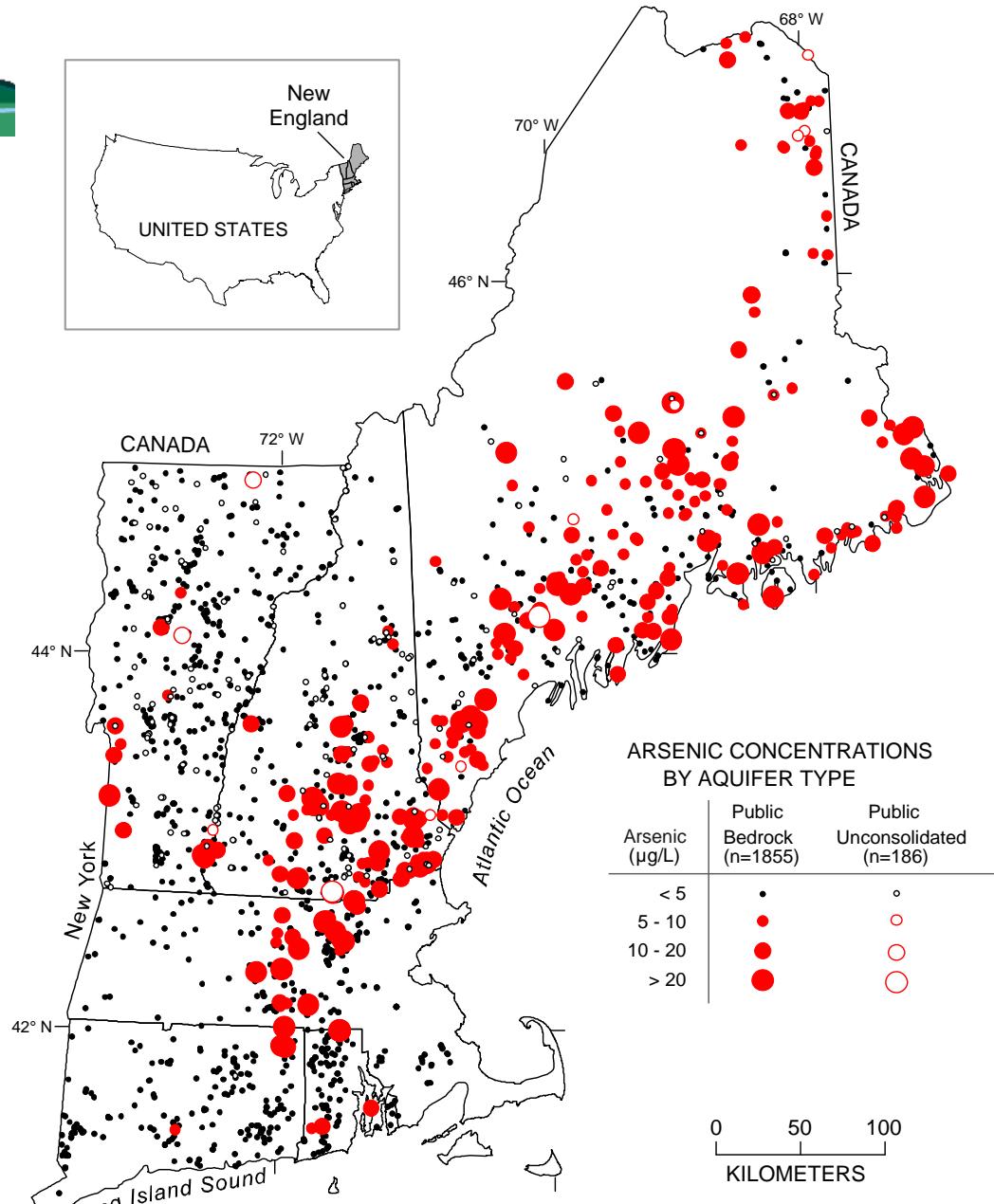
# Arsenic in drinking water = a global public health issue



- Worldwide, an estimated 250 million to 1 billion people are affected by excess arsenic in groundwater
- A WHO program of digging tube wells in India and Bangladesh to alleviate cholera problem led to exposure to excess arsenic in drinking water
- Highly contaminated areas (India, South America) can contain as much as 1800 ppb (180 times the WHO standard)

# Arsenic in water from public bedrock wells in New England

Approximately **one in five NH wells have arsenic in excess of the federal drinking water standard**, meaning 10% of the state's population (~120,000 people) could be chronically exposed to high levels of arsenic.

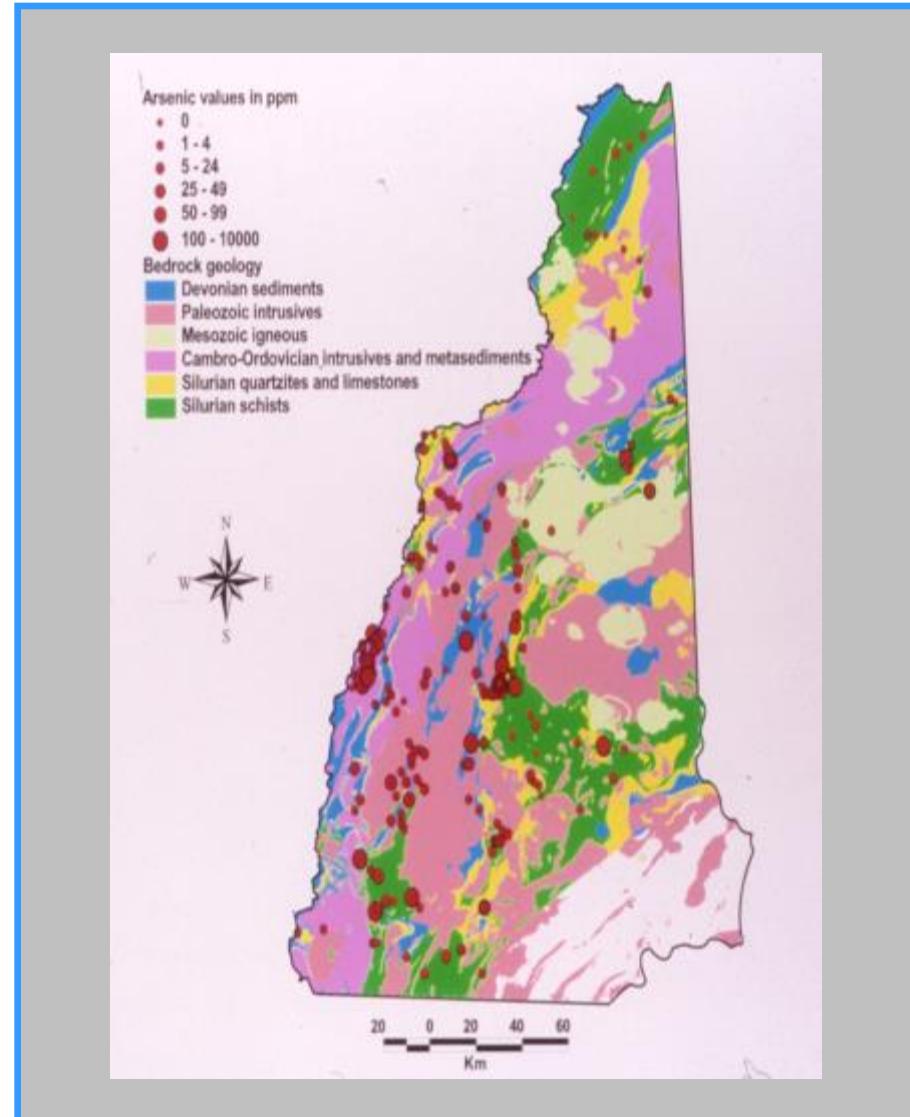


Ayotte et al. (2003). "Arsenic Groundwater in Eastern New England: Occurrence, Controls, and Human Health Implications." Environ. Sci. Technol. 37(10): 2075-2083.

FIGURE 1. Arsenic concentrations in source waters to public-supply wells in New England.

# New Hampshire “The Arsenic State”

(data from C. Page  
Chamberlain et al.,  
unpublished)





# Model-predicted probabilities of arsenic concentrations in groundwater from bedrock aquifers at 5 PPB.

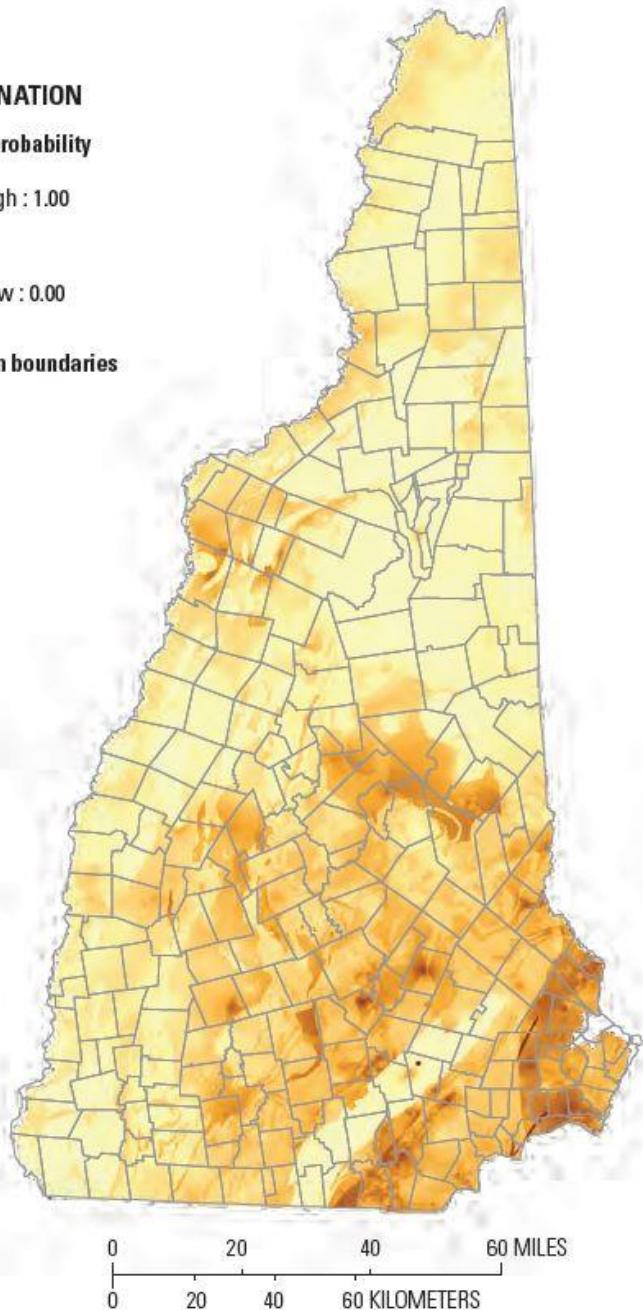
## EXPLANATION

Predicted probability

High : 1.00

Low : 0.00

Town boundaries



# **Arsenic in drinking water: possible health effects**

- Studies link exposure to arsenic in drinking water to a wide variety of adverse health effects:
  - Cancers (bladder, skin, kidney, liver, prostate and lung)
  - Vascular and cardiovascular disease
  - Reproductive and developmental effects
  - Cognitive and neurological effects
  - Diabetes and other metabolic disorders
  - Neuropathy

Hughes et al. (2011). “Arsenic Exposure and Toxicology: A Historical Perspective” *Toxicological Sci* 123(2): 305–332.

# Arsenic and lung disease

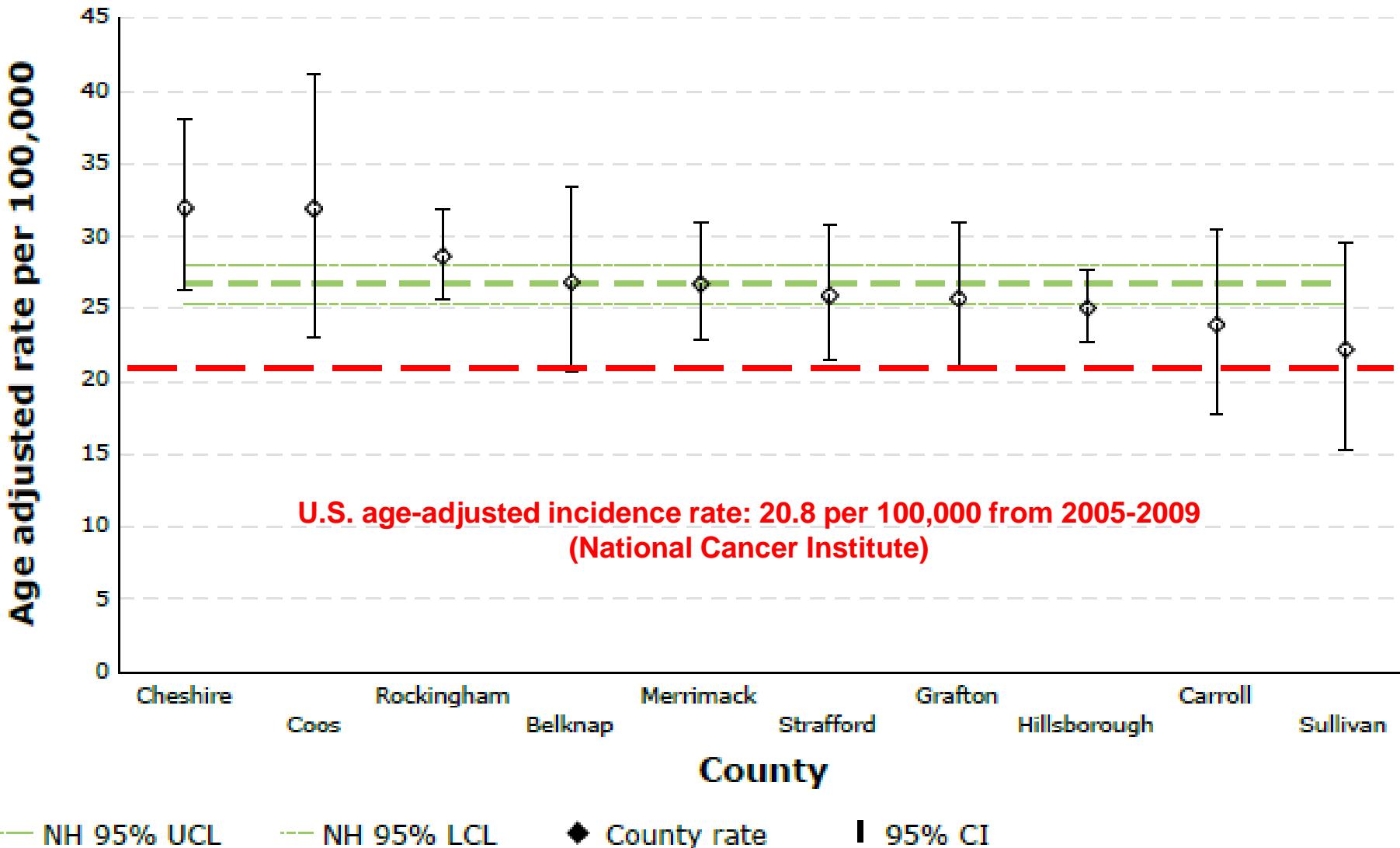
- Arsenic exposure is associated with increased risk of:
  - Lung Cancer
  - Bronchiectasis
  - Chronic Obstructive Pulmonary Disease (COPD)
  - Emphysema
  - Chronic Lung Infections
- Arsenic is unique in increasing lung disease risk via ingestion rather than (or in addition to) inhalation
- **Arsenic synergistically increases risk of lung disease from other lung toxicants including tobacco smoke, environmental air contaminants, bacterial and viral infections**

# Arsenic and bladder cancer

- There is a causal relationship between chronic ingestion of inorganic arsenic in drinking water and bladder cancer when levels are relatively high ( $\geq 150 \mu\text{g/L}$ ).
- **Cancer risk associated with lifetime ingestion of 10  $\mu\text{g/L}$  is much higher than it is for other MCLs**

## Bladder cancer incidence rates

NH residents; For 2005-2008; Both genders



Source: NH Environmental Health Tracking Program (2012)

# **Characteristics of arsenic that affect risk perception**

- No perceptual cues or reminders of presence of risk – colorless, odorless, tasteless
- Risk is generally natural; no villain to assign responsibility or blame
- Experience with risk is generally benign – may have lived in homes many years without any known health issues
- Deaths due to the risk are not dramatic, occur singly and impossible to unequivocally relate to the risk
- Exposure to the risk is voluntary in the sense that people choose where they want to live and which home to buy
- Effect of the risk is far removed from initial exposure (cancer takes many years to develop)
- Risk is not the same for everyone but varies in complex ways depending on several dimensions (geographic location, soil type, house structure, occupant behavior)
- Probability of the risk low in comparison to other activities (e.g., driving)

# Contact Info

## **Pierce Rigrod**

Environmentalist IV

Source Protection Program

Drinking Water & Groundwater Bureau

NH DES / 29 Hazen Drive / Concord, NH

Phone 603.271.0688 | Email: [Pierce.Laskey-Rigrod@des.nh.gov](mailto:Pierce.Laskey-Rigrod@des.nh.gov)

## **Michael Paul**

Community Engagement Core

Superfund Research Program

The Geisel School of Medicine at Dartmouth

HB 7660, Hanover, New Hampshire 03755

Phone: 603.643.3137 | Email: [michael.paul@dartmouth.edu](mailto:michael.paul@dartmouth.edu)