



PRIVATE WELLS IN NH

MAKING WATER TESTING & TREATMENT A PRIORITY

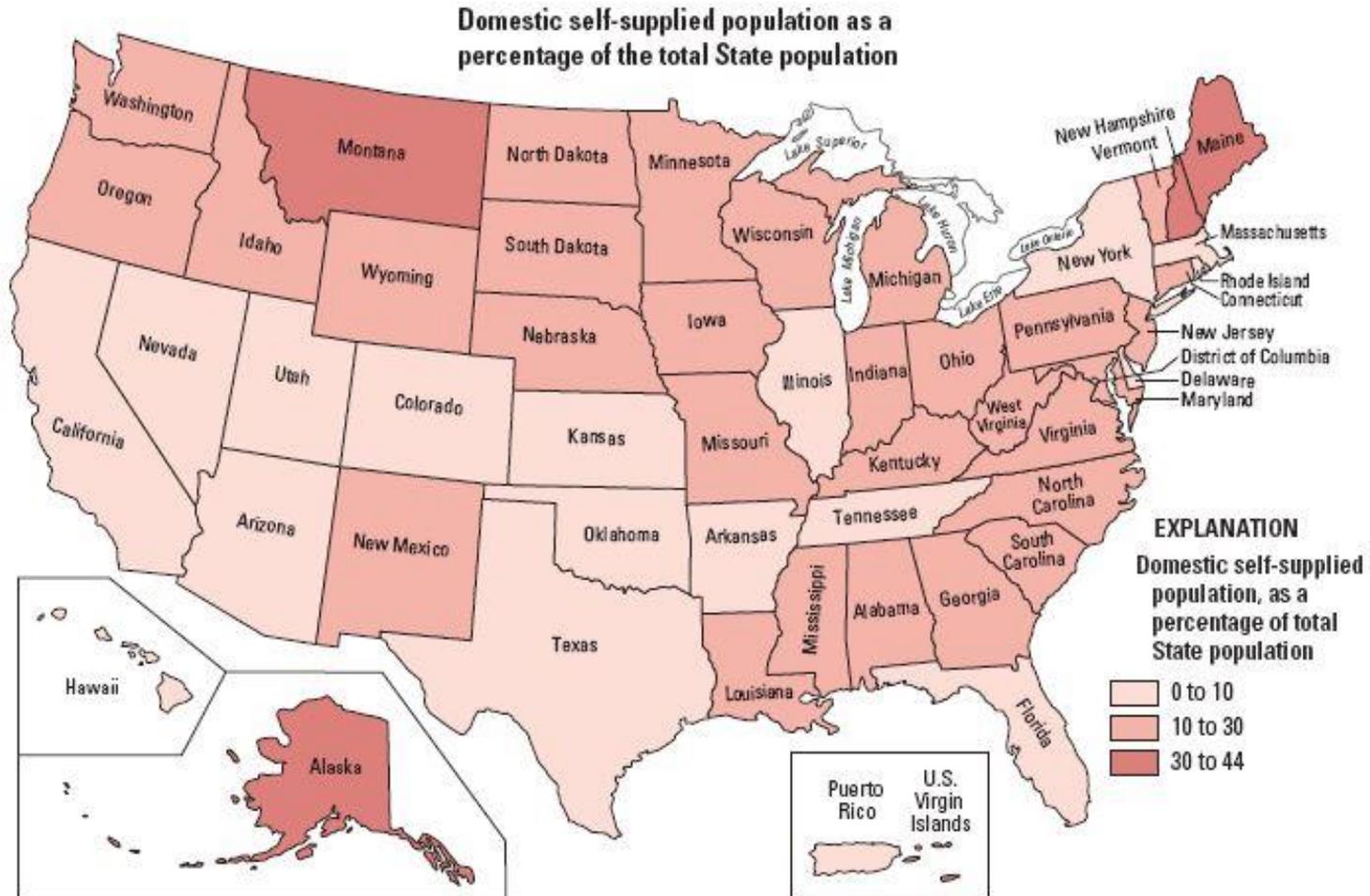


Private Wells in NH

- **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	Soil; aquifers; gasoline
		.05 mg/L	EPA SMCL	Some evidence that shower inhalation can cause toxicity	
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)

Periodic Table of the Elements

1	1A	H	2	He																																	
2	3	Li	4	Be	5	B	6	C	7	N	8	O	9	F	10	Ne																					
3	11	Na	12	Mg	13	Al	14	Si	15	P	16	S	17	Cl	18	Ar																					
4	19	K	20	Ca	21	Sc	22	Ti	23	V	24	Cr	25	Mn	26	Fe	27	Co	28	Ni	29	Cu	30	Zn	31	Ga	32	Ge	33	As	34	Se	35	Br	36	Kr	
5	37	Rb	38	Sr	39	Y	40	Zr	41	Nb	42	Mo	43	Tc	44	Ru	45	Rh	46	Pd	47	Ag	48	Cd	49	In	50	Sn	51	Sb	52	Te	53	I	54	Xe	
6	55	Cs	56	Ba	57	* La	72	Hf	73	Ta	74	W	75	Re	76	Os	77	Ir	78	Pt	79	Au	80	Hg	81	Tl	82	Pb	83	Bi	84	Po	85	At	86	Rn	
7	87	Fr	88	Ra	89	+ Ac	104	Rf	105	Ha	106	107	108	109	110																						

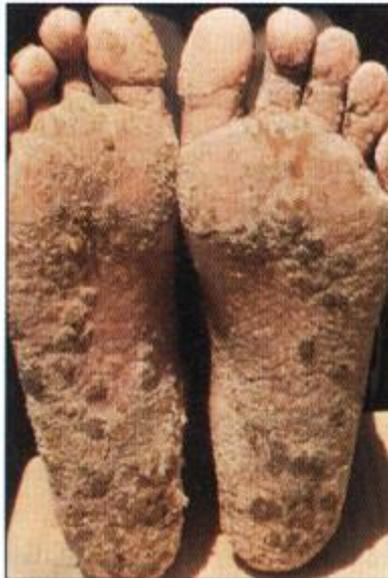
* Lanthanide Series

58	59	60	61	62	63	64	65	66	67	68	69	70	71
Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu

* Actinide Series

90	91	92	93	94	95	96	97	98	99	100	101	102	103
Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

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.

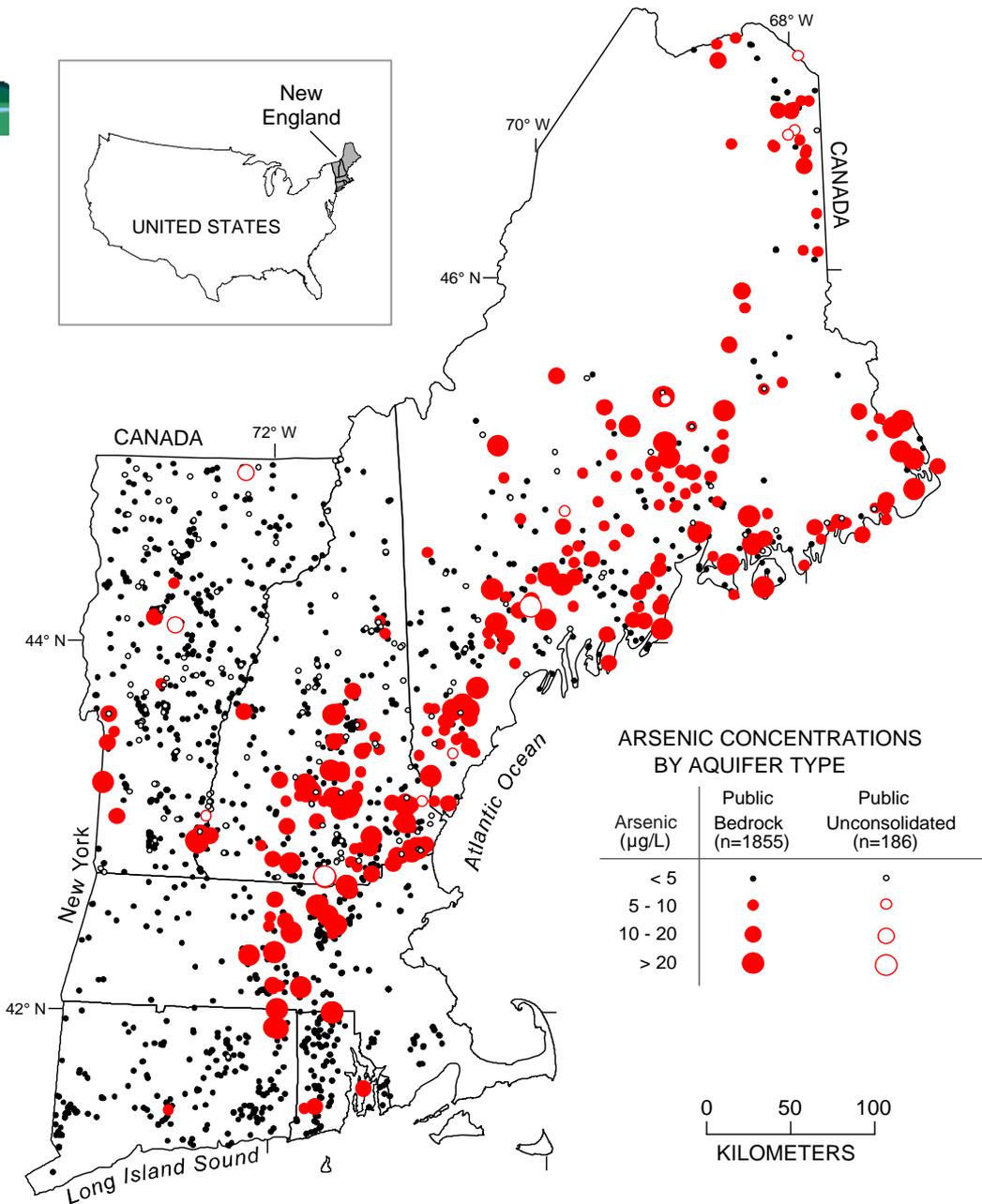
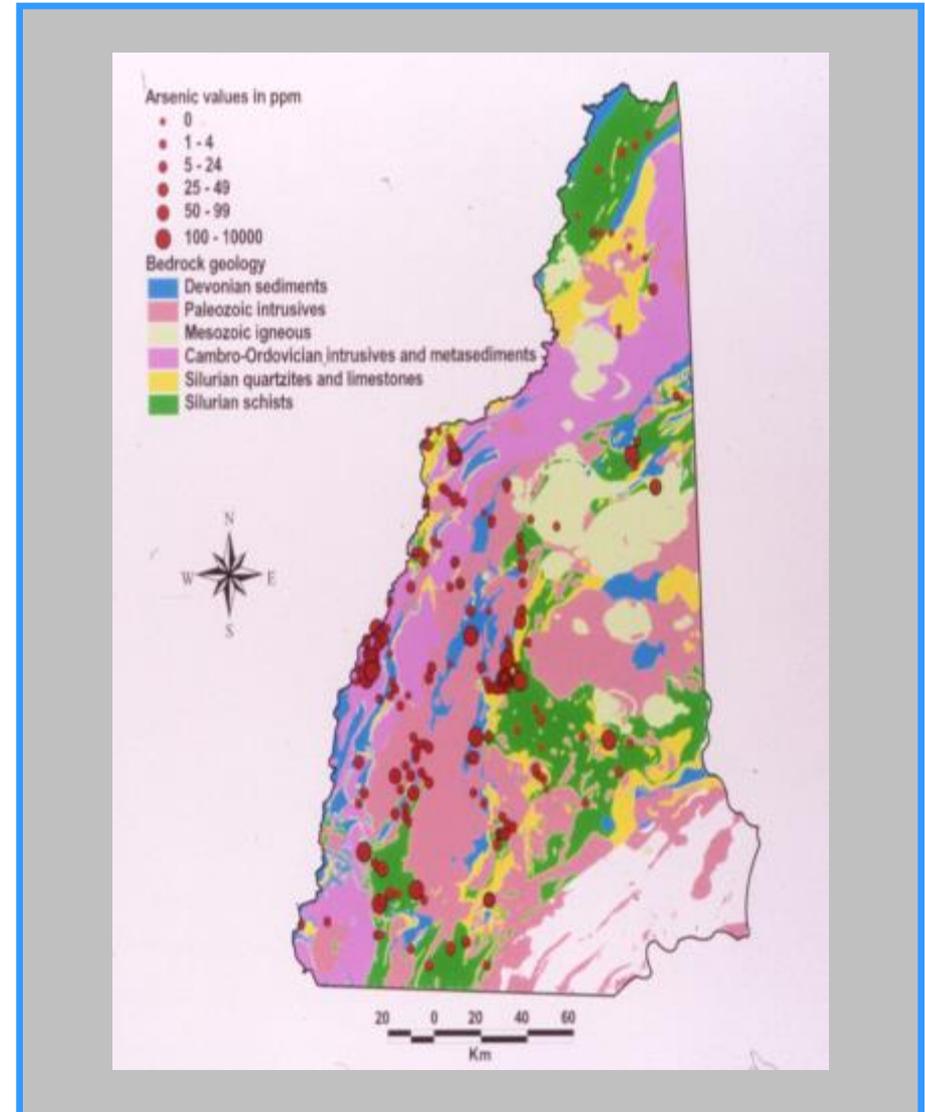


FIGURE 1. Arsenic concentrations in source waters to public-supply wells in New England.

New Hampshire “The Arsenic State”

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unpublished)





B. Arsenic ≥ 5 $\mu\text{g/L}$ model

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

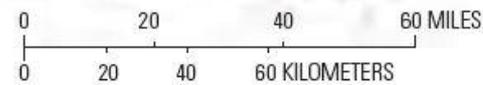
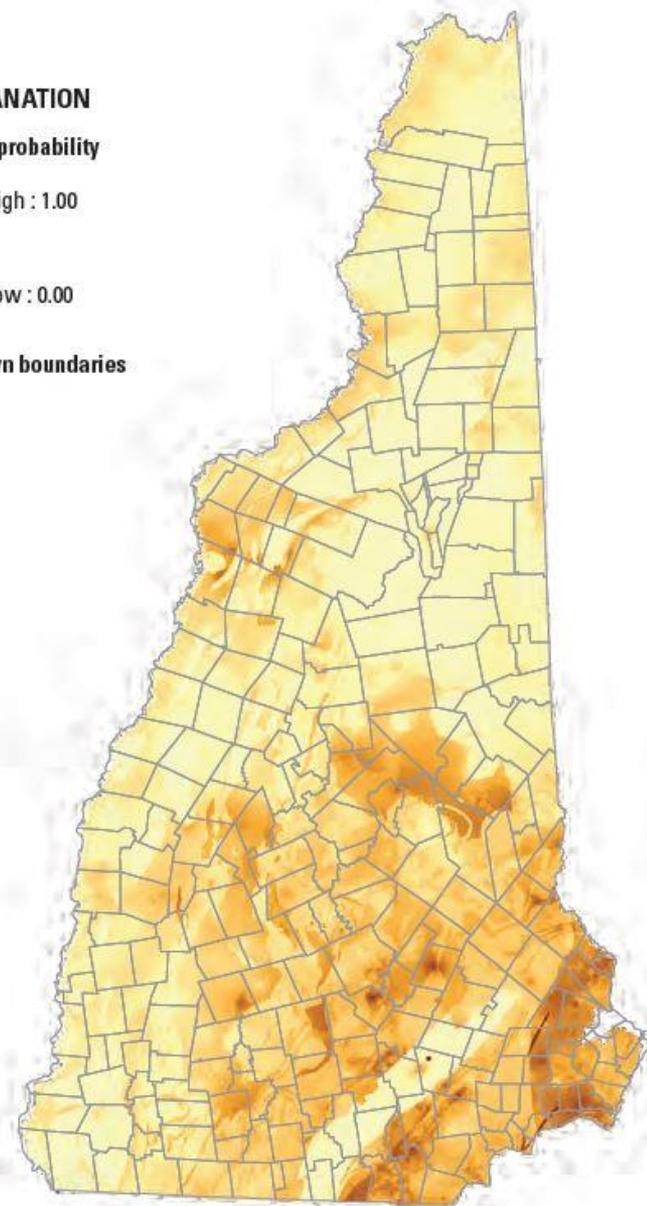
EXPLANATION

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

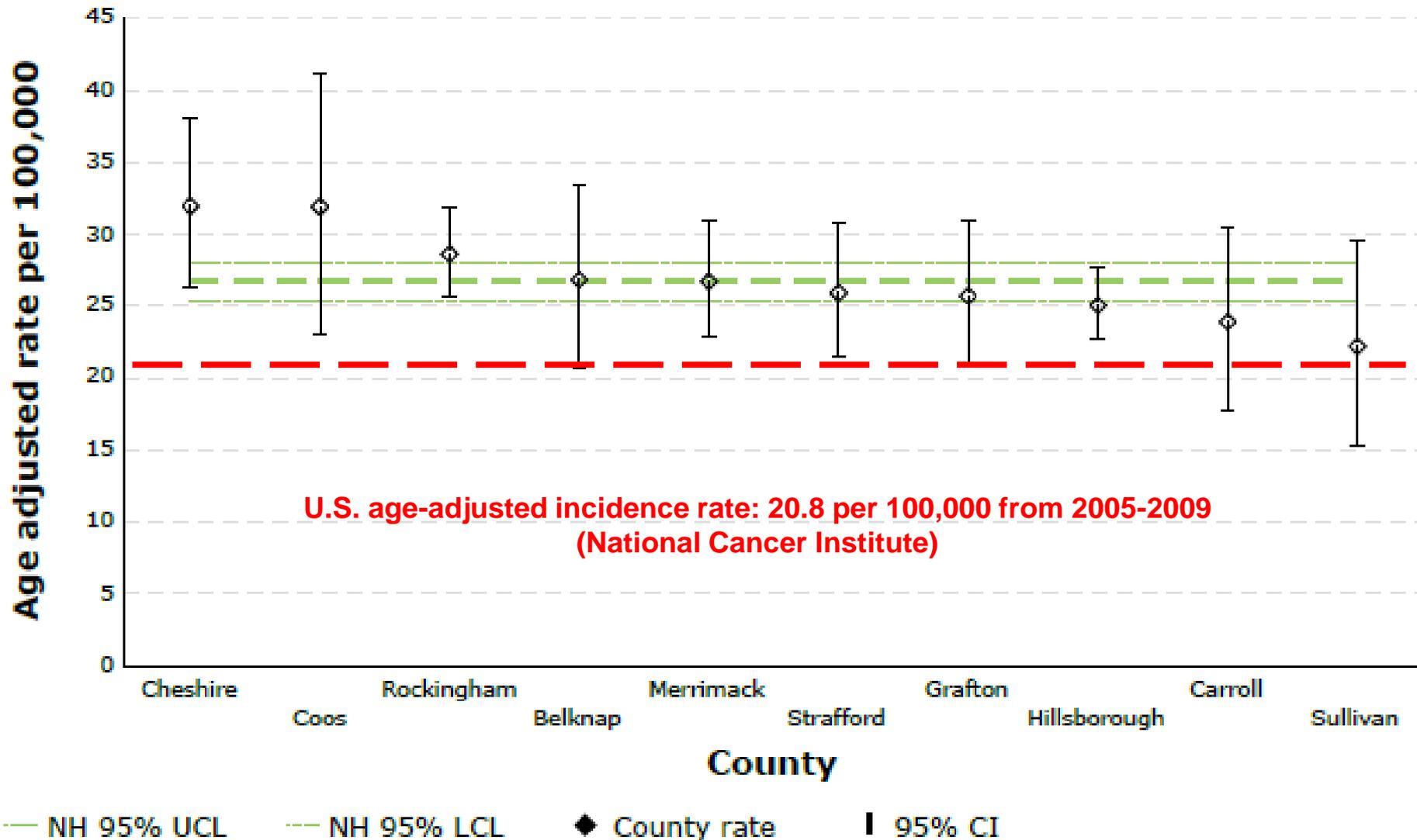
- Arsenic exposure is associated with increased risk of:
 - Lung Cancer
 - Bronchiectasis
 - Chronic Obstructive Pulmonary Disease (COPD)
 - Emphysema
 - Chronic Lung Infections
- Arsenic is unique in increasing lung disease risk via ingestion rather than (or in addition to) inhalation
- **Arsenic synergistically 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

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