BIOMONITORING
MEASURING CHEMICALS IN PEOPLE
FRIDAY, JUNE 30, 2017
1:00 PM ET/ 12:00 NOON CT/
11:00 AM MT/10:00 AM PT
Presenters

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Using Biomonitoring to Assess Chemical Exposures at the National and State Level

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National Center for Environmental Health
Centers for Disease Control and Prevention

National Conference of State Legislatures
Webinar
June 30, 2017
WHAT IS BIOMONITORING?
Biomonitoring is...

- **Definition**: Measuring the chemical or its reaction product in human specimens (e.g. blood, urine) to assess internal dose in people.
  - Integrates all sources and routes of exposures
  - Measures trace concentrations

- **A useful tool for exposure assessment**
THE NATIONAL BIOMONITORING PROGRAM
Advanced laboratory science to improve the detection, diagnosis, treatment, and prevention of disease and to support public health response to threat agents
National Biomonitoring Program

Provide laboratory science that improves the detection, diagnosis, treatment, and prevention of disease resulting from exposure to environmental chemicals

- New and improved, high-quality biomonitoring methods for priority environmental chemicals.
- Assessment of U.S. population’s exposure to priority environmental chemicals using ongoing biomonitoring of NHANES participants.
- High-quality biomonitoring measurements in more than 65 studies per year to determine safe and harmful human exposure levels.
- Effective laboratory support for CDC emergency responses that involve known or potential exposure to environmental chemicals.
- Analytical support, training, and technology transfer to state and local laboratories to support investigations of known and potentially harmful exposures.
NHANES: How we assess exposure of the U.S. population to priority environmental chemicals

- National Health and Nutrition Examination Survey (NHANES)
  - Began in 1971
  - Continuous survey since 1999 (survey cycle = 2 years)
  - Stratified, multistate national probability samples
  - About 10,000 participants in 30 locations every 2 years

- Methods
  - Face-to-face and computer-assisted interviews:
    - Demographics
    - Socioeconomic
    - Dietary
    - Health-related topics
  - Physical examination
  - Biological specimen collection

More at: http://www.cdc.gov/nchs/nhanes/about_nhanes.htm
National Report on Human Exposure to Environmental Chemicals and Updated Tables

- The most comprehensive assessment of Americans’ exposure to environmental chemicals
- Biomonitoring data for 300+ chemicals including pesticides, metals, and chemicals in everyday products
- Establishes national exposure levels and trends over time
- Used by scientists and public health officials to identify harmful exposures
- Updated with new biomonitoring results every year
Updated Tables, January 2017

- Updated Tables reported in 2 volumes
  - Volume 1 – U.S. general population
  - Volume 2 – Pooled samples, adult cigarette smokers and nonsmokers
    - POPs and pesticides in individual and pooled samples
    - Data for special sample of adult smokers and nonsmokers

- Presents data for 304 chemicals
  - 20 reported for the first time
  - 96 with updated data since Updated Tables, February 2015

www.cdc.gov/exposurereport
NATIONAL EXPOSURE TRENDS OVER TIME
PFOS precursors phased out (2000-02)
PFOS human levels reduced by 68% since 1999-2000

Prevedouros et al. ES&T 2006, 40:32-44
Exposure to Phthalates & Organophosphate Insecticides

- DiNP increasing (↑265%)
- DEHP decreasing (↓-67%)
  - Legislative actions & public scrutiny
- 1996 FQPA
- Phase-out residential use of chlorpyrifos (2000-1)

www.cdc.gov/exposureresport
Secondhand Smoke Exposure in US Population

NHANES Serum Cotinine Trend: 1988-2012

84% decline 1988-2012

Geometric Mean ± 95% CI

Year


Serum Cotinine, ng/mL

0.30 0.25 0.20 0.15 0.10 0.05 0.00

(8090) (9192) (5999) (6320) (6197) (6109)
STATE BIOMONITORING PROGRAMS
CDC provides technical expertise, technology transfer, training, quality assurance, and funding.

- Funding helps states assess chemical exposures of concern in their communities.
  - Purchase laboratory equipment and supplies
  - Hire and train specialized staff
  - Conduct fieldwork and data analysis
  - Communicate results to study participants
2014-2019
State Biomonitoring Cooperative Agreement

California
- Metals
- PFAS
- PCBs
- Flame Retardants
- PAHs
- Environmental Phenols
- Phthalates

Four Corner States
- Metals
- 2, 4 dichlorophenol
- Phthalates
- Pyrethroids

New Hampshire
- Arsenic
- Uranium
- PFAS

Massachusetts
- PCBs
- Metals

New Jersey
- PFAS
- PCBs
- Metals
- Volatile Organic Compounds

Virginia
- Perchlorate
- Uranium
- PAHs
Developing Biomonitoring Capabilities

**Epidemiology**
- Participant recruitment and enrollment process
- IRB approval
- Data collection and management system
- Reporting results back to participants
- Advisory panel

**Laboratory**
- Develop, standardize and validate methods
- Sample processing
- Laboratory analysis
California

Measuring Analytes in Maternal Archived Serum (MAMAS)
- Assess exposure to metals, PFAS, PBDEs, PCBs, and OCPs during pregnancy using archived maternal serum specimens

Foam Replacement Environmental Exposure Study (FREES)
- Compares levels of PBDEs and OPFRs in participants before and after foam furniture replacement

Asian/Pacific Islander Community Exposures (ACE) Project
- Assess exposure to metals and PFAS in 60 Chinese adults living in San Francisco Bay Area

www.biomonitoring.ca.gov
Four Corner State Biomonitoring Consortium (Utah, New Mexico, Colorado, Arizona)

Private Well Drinking Water Metal’s Contamination Study
• Assess exposure of heavy metals in private wells in Utah, New Mexico and Arizona

The Exposure of Four Corner States Resident’s to Metals, Pesticides and Consumer Products
• Assess exposure of 2,4-dichlorophenoxyacetic acid (2,4-D) containing herbicide
• P-dichlorobenzene (p-DCB) contaminates found in disinfectants, deodorants and some kinds of pesticides
• Phthalate contaminates in food and domestic products
• Pyrethroid-containing insecticides

San Luis Valley Children’s Study
• Study of chemical exposures in 3 to 13 year old children in the San Luis Valley

http://www.4csbc.org/
New Hampshire

Biomonitoring New Hampshire

- Measure total arsenic and uranium in 500 residents of southern New Hampshire who rely on private bedrock wells for drinking

State – Wide Surveillance Study

- Measure chemical contaminants of concern in blood and urine for metals, cotinine, pesticide metabolites and PFAS in a statewide population

New Hampshire PFAS Response

- NH facilitated specimen collection, processing, shipment and results reporting for 1587 individuals tested for PFAS exposure as the result of drinking contaminated water at the Pease Tradeport

http://www.dhhs.nh.gov/dphs/lab/biomonitoring.htm
The Exposure of Virginia Residents to Toxic Metals and Perchlorate

- Assess exposure to toxic metals and perchlorate in the general population in Virginia

The Exposure of Firefighters to Toxic Combustion Products

- Coordinate with Virginia Department of Fire programs to assess exposure to cyanide and PAH metabolites in firefighters

Massachusetts

Biomonitoring Massachusetts Study

- Population-based sampling system Behavioral Risk Factor Surveillance System Survey (BRFSS) to recruit participants and assess exposure to metals and polychlorinated biphenyls (PCBs)

Identify Targeted Sample of Massachusetts Population

- Assess exposure to metals in vulnerable populations in the Boston area

Respond to Acute Chemical Exposure Incidents

- Rapid response to accidental mercury exposure for three separate incidents
New Jersey

Environmental Contaminant Levels in Blood and Urine Specimens from New Jersey Clinical Laboratories and Blood Banks

- Developed strategic partnerships to collect samples representative of the state population to assess exposure to PFAS, PCBs and metals

Assessing PFNA Body Burdens Following Drinking Water Intervention

- Monitor an individual’s exposure to PFAS over a three-year period in targeted communities suspected of elevated levels in drinking water

Assessing Environmental Exposure of Expecting Women in New Jersey to Toxic Metals, PCBs, and PFAS

- Intervention in pregnant women exposed to environmental contaminants and assessing outcomes
Previously CDC Funded States

New York

New York PFAS Response

• Assessment exposure to PFOA in Hoosick Falls residents in contaminated water through development of rapid high quality analytical method for 11 PFAS.

  Journal of Chromatography B, 1049-1050 (2017) 24 -29

• Washington

  • Analytical capabilities for metals, phthalates, and creatinine for research studies and public health departments.
Summary

- Biomonitoring measures the amount of chemicals directly in a person’s body.
- National Biomonitoring Program
  - National Health and Nutrition Examination Survey (NHANES)
  - National Report on Human Exposure to Environmental Chemicals
- State Biomonitoring Programs
- National Biomonitoring Network
The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.
Christine Bean
New Hampshire State Laboratory
Biomonitoring New Hampshire

NH Public Health Labs

CDC’s Division of Laboratory Sciences
5 year, $5 million cooperative agreement

New Hampshire’s Projects:
• Targeted Arsenic and Uranium Public Health Study
• State-wide surveillance
• 9/1/14 – 8/31/19
Potential for Arsenic & Uranium Exposure

- 46% of the state population is reliant on wells for drinking water
- NH’s geology and agricultural history
- 31% of samples collected in southern NH exceeded arsenic MCL (NH PHL data, 2005-2006)
  - Urine: detected elevated uranium when arsenic was elevated
Wells in New Hampshire
What kind do you have?

40% of New Hampshire residents get their water from wells. There are different types of wells and different reasons for having each.

**Purpose:** Wells may be constructed based on the amount of water needed for the building. For example, an apartment building needs more water than a single family home, so a drilled well may be used. More water is available when wells are dug deeper (see diagram below).

**Environment:** What is beneath the soil can impact what type of well can be constructed. For example, dug wells can be used in sand, while drilled wells must have bedrock. Climate is also important. In dry areas, a deeper well can mean less impact by drought.

**Safety:** Well water can become contaminated, making it unsafe to drink. Contamination may be bacterial, such as from septic failure. It may also be caused by natural chemicals that can be found in the ground, such as arsenic and uranium. Surface pollution from runoff, fertilizers, pesticides, and landfill seepage can also cause well contamination.

<table>
<thead>
<tr>
<th>Types of NH Wells</th>
<th>Well Type</th>
<th>Other Names</th>
<th>Depth (feet)</th>
<th>Risk of Contamination &amp; Other Concerns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dug</td>
<td>Spring</td>
<td>10-30</td>
<td>Dug wells have the highest risk of contamination from bacteria and the highest risk of surface pollution. Drought may impact dug wells.</td>
<td></td>
</tr>
<tr>
<td>Driven</td>
<td>Point, Gravel, or Washed</td>
<td>30-50</td>
<td>Driven wells have a lower risk of contamination from bacteria, but are at moderate to high risk of surface pollution. Drought may impact driven wells.</td>
<td></td>
</tr>
<tr>
<td>Drilled</td>
<td>Bedrock, Artesian, Cable-Tool, or Pounded</td>
<td>100-400</td>
<td>Drilled wells have the lowest risk of contamination from bacteria, but the highest risk of natural chemical contaminants, such as arsenic and uranium.</td>
<td></td>
</tr>
</tbody>
</table>

How do I know if my well water is safe?

You can take a water sample from your tap and send it to a lab for testing. The test you choose depends on the contaminants you want to look for. It may also depend on the type of well you have and related risks. For example, you may not be concerned about radon in a dug well, but you may want to know about bacterial runoff. Bacterial testing should be done every year, while chemical testing should be done every few years, depending on the concern.

The NH Department of Environmental Services provides a list of companies that offer water testing:

Sources:
- Drinking Water/Ground Water Fact Sheets. NH Department of Environmental Services, 2014.
Targeted Arsenic & Uranium Public Health Study

- Hillsborough, Strafford, & Rockingham counties; some towns in Merrimack County
- Participant recruitment
  - 28 towns
  - Community meetings, events, news releases, letters, social media, website
  - Postcards
- Goal: n=500 well water, n=50 public water

Probability of As > 10 ppb in well water; USGS modeling prepared by J. Chipman.
http://www.dartmouth.edu/~toxmetal/assets/pdf/Wellreport.pdf
Study Design

Participant recruitment
- High & low risk areas
- Community meetings, events, news releases, social media, website
- Postcards

Goal: n=500 well water, n=50 public water
Proposed Study Area

Affected Communities

Arsenic Contaminated Wells
How did we identify communities?

Well data from NHDES
+ Tax data from NH Dept. of Revenue Administration + 1 amazing DPHS GIS analyst
= Spreadsheet of confirmed residences with wells!
June: Bow, Brown Hill Testing Project special meeting
August: Epsom Selectmen meeting
September: Bow Drinking Water Committee
*More to be scheduled...*
We come in contact with chemicals every day. They are in the food we eat, the air we breathe, and the objects that surround us. The question is—How much of those chemicals is actually getting inside our bodies? Are those chemicals causing disease or are they not harmful to us?

**We need your help to answer these questions!**
We Need Your Help!

Why? We are conducting a targeted public health study looking at the relationship between two chemicals that might be in your well water (arsenic and uranium) and whether those chemicals are getting into your body.

How long will it take? Less than 2 hours of your time over the course of a few days.

What will I need to do? Answer some survey questions, collect water from your faucet, and collect a urine specimen. All materials for collection and returning the specimens will be provided.

What do I get in return? Free well water and urine tests from the New Hampshire Public Health Laboratories. Your well water and urine will be tested for arsenic and uranium (common chemical contaminants to well water in NH). Your well water will also be tested for other chemicals, free of charge. We will refer you to someone who can help with interpreting results, should you need it. All of your information will be kept confidential and will only be used for study purposes.

How do I sign up? Please call Amanda Cosser, Study Coordinator, at (603) 271-4611 or Melissa Levesque, Program Specialist, at (603) 271-5113 to enroll or ask questions. You may also email us at BiomonitoringNH@dhhs.nh.gov or register online at: https://www.surveymonkey.com/r/DB6HN8Z.

Financial and technical assistance is being provided through cooperative agreement with the Centers for Disease Control and Prevention (CDC) Division of Laboratory Sciences at the National Center for Environmental Health RFA EH41-0202. The contents of these pages do not necessarily represent the official views of the CDC.

Visit our website to learn more! http://www.dhhs.nh.gov/dphs/lab/biomonitoring.htm.
The NH Biomonitoring Program

What is Biomonitoring?

Biomonitoring is a way to measure environmental chemicals in people. There are many natural and man-made chemicals in our environment. Some are harmless to us, but others can cause disease or poor health such as cancer, diabetes, heart disease, or developmental delays. Biomonitoring tells us whether chemicals in the environment are entering our bodies. It can also tell us whether interventions, like treatment or removing products from homes or work, help reduce the amount of these contaminants in our bodies. With this knowledge, we can better protect you, your family, and your community’s health.

- Biomonitoring New Hampshire is currently looking at two chemicals that are present in well water in NH and whether they are getting into people’s bodies. Learn more on the Targeted Arsenic and Uranium Public Health Study page.

How do chemicals get into our bodies?

Environmental chemicals get into our bodies in many ways:

- Through eating, drinking, and breathing.
- By using certain products at home or work.
- Through some recreational or job activities, like painting or working with pesticides.
- By taking certain supplements or herbal remedies.

Finding a chemical in your body doesn’t mean that you will get sick. Whether you get sick depends upon many factors, such as which and how much of the chemical gets into your body and personal traits such as your health status, genetics, and behaviors.

Why is it important to collect Biomonitoring samples?

Biomonitoring helps us:

- Determine which chemicals are getting into people,
- Find out how much of those chemicals are getting into people, and
- Identify who is at risk from these chemicals.
Collaboration - Academia

- Dartmouth
- University of New Hampshire

Firsthand Experiences

To learn more about what participating in the study would be like, check out this website where Sarah blogs about her firsthand experience as a participant.

See the videos below to better understand what kind of questions the study interview involves and to learn how to collect your water sample.

- https://biomonitoringnh.wordpress.com
- https://wellwaternh.wordpress.com
- https://www.youtube.com/watch?v=MdPNMbPpO7Y
Working with community practices to distribute water test kits and encourage water testing

First round of kit dissemination to 12 community practices

NH PHL provides kits to the primary care offices

Opportunity to educate patients about environmental health issues at well care visit
Is there Arsenic in your drinking water?

DO YOU LIVE IN NH?
DO YOU GET YOUR WATER FROM A WELL?
THEN YOU MAY HAVE ARSENIC IN YOUR DRINKING WATER.

What is arsenic and why is it dangerous?
Arsenic is a chemical that is naturally found in the environment. Even though it is natural, it can still be very harmful to your health. If you drink or cook with water that contains arsenic, then you could develop health conditions such as:
- Bladder cancer
- Other cancers like lung cancer, prostate cancer, and liver cancer
- Heart disease and diabetes
- Brain and nerve diseases
- Effects on brain development and decreased IQ in children

How do I know if my well water has arsenic?
1 out of 5 wells in NH may contain dangerous amounts of ARSENIC.

Bottom line: you won’t know it’s there unless you test for it. Arsenic has no smell, no taste, and no color. You can take a water sample from your tap and send it to a lab for testing. Most well water testing will look for arsenic and other dangerous contaminants. You should test your well every 3 years.

The NH Department of Environmental Services (DES) provides a list of companies that offer water testing:

What can I do if my water contains arsenic?
You can treat the water in your home to remove the arsenic. You can use simple filters on your kitchen tap or more complicated systems to treat all the water in your home. The NH DES provides information on treating well water for arsenic and other chemicals here:

For more information on well water testing in NH, please contact the New Hampshire Public Health Labs:
29 Hazen Drive, Concord, NH 03301
(603) 271-4661
http://www.dhhs.nh.gov/dhhs/lab/monitoring.htm
Is there **Uranium** in your drinking water?

How it can affect you and your family.

What is uranium and why is it dangerous?

Uranium is a radioactive substance that is found in nature. It can be found in the air, soil, food, and water. The amount of uranium in your environment can be increased by industrial activity, such as local mines or mills.

While a very small amount of natural uranium in your environment is okay, higher levels of uranium can be **harmful to your health**.

How can uranium affect me?

The most common ways for uranium to enter your body are through your food and drinking water. Uranium exposure can damage your kidneys. Kidneys help you stay healthy by:

- Removing waste from your blood,
- Making red blood cells,
- Controlling your blood pressure, and
- Keeping your bones healthy.

Over time, damage to your kidneys can lead to organ failure, which can be dangerous, even life-threatening.

What can I do about it?

*Consider testing your water:* You can take a water sample from your tap and send it to a lab for testing. Because levels change over time, you should test your water every 3 years. The NH Department of Environmental Services (DES) provides a list of companies that offer water testing:


*What to do if high levels of uranium are found:* If you are concerned, a short term option is to drink bottled water. You can also install a treatment system to make sure your water is safe, long term. Uranium treatment systems will also protect against some other dangerous substances. The most important spot to treat is any faucet that supplies drinking water. You will need to consider factors such as other contaminants that may be in your water, water usage, and cost. A water treatment expert can help you make the right decision for you and your family. The NH DES also provides a fact sheet about water treatment system options:


For more information on well water testing in New Hampshire, please contact the NH Public Health Lab:

29 Hazen Drive, Concord, NH 03301

(603) 271-4694

[http://www.dhhs.nh.gov/dphs/lab/biomonitoring.htm](http://www.dhhs.nh.gov/dphs/lab/biomonitoring.htm)
Interview Meeting

- Informed Consent/Assent
- Exposure Questionnaire
- Food Log
- Urine Specimen Collection
- Water Sample Collection
Lab Testing

Urine
- Creatinine
- Total Arsenic
- Uranium
- Arsenic speciation if As > 20ug/g creatinine
  - As(III)
  - As(V)
  - DMA
  - MMA
  - Arsenobetaine
  - Arsenocholine

Water
- Stagnant (0min):
  - Lead
  - Copper
- Flushed (5min):
  - Arsenic
  - Uranium
  - Manganese
  - Cadmium
  - Lead
  - Copper
  - Iron
  - Hardness
  - pH
## Your Urinary Arsenic Test Results

Compared with Participants in this Study and with National Averages

<table>
<thead>
<tr>
<th>Analyte Tested</th>
<th>Your Result (μg/g creatinine)*</th>
<th>Levels of Others in this Study (μg/g creatinine)</th>
<th>Levels in the U.S. Population** (μg/g creatinine)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Lowest</td>
<td>Highest</td>
</tr>
<tr>
<td>Total Arsenic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speciated Arsenic****</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As(III) Arsenous (III) acid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As(V) Arsenic (V) acid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DMA Dimethylarsinic acid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MMA Monomethylarsonic acid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arsenobetaine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arsenocholine</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Creatinine is a protein that is excreted in your urine. By measuring the amount of creatinine in your urine, we can account for how diluted your urine is (i.e., how well hydrated you are).

**U.S. population numbers are from the Fourth National Report on Human Exposure to Environmental Chemicals, Updated Tables (February, 2015).

***95th Percentile: The level that 95% of the participants tested at or below.

****Speciated Arsenic testing was performed if your Total Arsenic result was greater than or equal to 20 μg/g creatinine. This is to determine the types of Arsenic in your urine. If your Total Arsenic result was less than 20 μg/g creatinine, no further testing was done.

These test results are for informational use only and are not intended for diagnostic purposes. A health level of concern has not been established for arsenic in urine, however the Environmental Protection Agency has established an arsenic maximum contaminant level of 10 parts per billion in drinking water. Please refer to your well water testing results.
Frequently Asked Questions

Arsenic

What is Arsenic?

- Arsenic is a chemical that is found naturally in the earth’s crust. It is in our air, water, and soil.
- It is also added to the environment by humans due to certain activities, such as using it in pesticides and as a preservative in pressure treated wood.
- There are two types of arsenic: inorganic and organic.
  - Organic arsenic is often found in living organisms such as fish and plants.
  - Inorganic arsenic is found in contaminated ground water and foods that have been grown with contaminated ground water.
- Inorganic arsenic is much more harmful to humans and mammals than organic arsenic.

Is Arsenic safe?

- Finding Arsenic in your urine does not mean you will get sick.
- The current science cannot tell us if long-term low-level exposure to arsenic (<100ug As/L water) will make you sick. More research needs to be done.
- Studies of long-term arsenic exposure in rodents and in humans in other countries (those that have different water, food, and healthcare than the United States) have shown arsenic can make you sick. This includes an increased risk of:
  - Skin, lung, and bladder cancers
  - Cardiovascular disease
  - Diabetes
  - Hypertension (high blood pressure)
  - Non-cancerous skin effects (such as lesions and spots)
  - Childhood neurodevelopmental effects (brain development)
  - Decreased verbal IQ scores in children
- Sudden or acute arsenic poisoning can cause vomiting, diarrhea, muscle cramping, and even death.
- Organic arsenic, like the kind found in fish and seafood, is not thought to be harmful to humans.

How did I come in contact with Arsenic?

- Arsenic can come from many places. The most common is from contaminated drinking water and food.
  - Arsenic is leached into ground water from rocks.
  - Not all drinking water contains high levels of arsenic though.
  - Public water systems are under strict regulations to make sure Arsenic levels are safe.
  - There are no regulations to make sure well water is safe. It is up to the homeowner or resident to have their well water tested every 3-5 years.
- Some food may contain arsenic. Scientists have found arsenic in rice, rice products (cereals/cakes/crackers/beverages), fish, shellfish, produce, grains, wine, and some supplements.
- Cooking with arsenic-contaminated water will introduce arsenic to your food.
- Smoking tobacco contains arsenic.

Arsenic has been used in medicine. Arsenic trioxide or Trisarsen is used to treat acute promyelocytic leukemia.

Some jobs may involve working with arsenic or materials that contain arsenic. These jobs include:
- Smelting
- Mining
- Electronic manufacturing or recycling
- Construction
- Landscaping
- Kessels fuel combustion (coal)
- Working with poultry feed or industrial waste

Sometimes arsenic is used in paints, glazes, or pigments for arts and crafts. Examples of these include opaline, glass, green, and copper oxide.

What should I do?

- Test your well water. Install a water treatment system or drink and cook with bottled water if your well water arsenic levels exceed 10 parts per billion (10 ppb).
- Ask your supervisor if you come into contact with arsenic at work. Discuss ways to protect yourself from contact.
- Never burn pressure treated wood. Dispose of it properly.
- Wash your hands after playing on or touching wooden structures such as playgrounds, picnic tables, or fences.
- Do not use products, fertilizers, or poultry foods that contain arsenic.

For more information, please visit our website at [http://www.dhhs.nh.gov/dhhs/de/biomonitoring.htm](http://www.dhhs.nh.gov/dhhs/de/biomonitoring.htm) or contact Arsenic Control, Study Coordinator and Biomonitoring Program Manager, New Hampshire Division of Public Health Services, at (603) 271-4612 or (603) 882-2819, ext 4611.

Revised January 2016
**DRINKING WATER RESULTS**

<table>
<thead>
<tr>
<th>CONTAMINANT</th>
<th>RESULT and LIMIT (mg/L)</th>
<th>RESULT and LIMIT (µg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Result</td>
<td>Limit</td>
</tr>
<tr>
<td>Arsenic</td>
<td>0.0041</td>
<td>0.01</td>
</tr>
<tr>
<td>Cadmium</td>
<td>Not Detected</td>
<td>0.005</td>
</tr>
<tr>
<td>Copper</td>
<td>0.13</td>
<td>1.3</td>
</tr>
<tr>
<td>Copper, Stagnant</td>
<td>0.24</td>
<td>1.3</td>
</tr>
<tr>
<td>Hardness</td>
<td>3.7</td>
<td>Not established</td>
</tr>
<tr>
<td>Iron</td>
<td>0.092</td>
<td>0.3</td>
</tr>
<tr>
<td>Lead</td>
<td>0.0024</td>
<td>0.015</td>
</tr>
<tr>
<td>Lead, Stagnant</td>
<td>0.0039</td>
<td>0.015</td>
</tr>
<tr>
<td>Manganese</td>
<td>0.021</td>
<td>0.05</td>
</tr>
<tr>
<td>Uranium</td>
<td>0.0015</td>
<td>0.03</td>
</tr>
</tbody>
</table>

The pH of your well water is 8.07. The normal range for ground water is 6.0 - 8.5.

**How to Interpret Your Results**

- The two Result values provided for each contaminant are equal. (Example: 1.122 mg/L = 1122 µg/L = 1122 ppb)
- "Limit" reflects the Maximum Contamination Level (MCL) if one exists or a secondary or recommended level if another State or Federal action level.
- "Stagnant" refers to the buildup of contaminants in water that has been sitting for a prolonged period of time, such as overnight.

For assistance interpreting your results and obtaining information regarding water treatment visit the NH Department of Environmental Service’s website at [www.des.nh.gov](http://www.des.nh.gov) and search “Be Well Informed”. You may also go directly to [https://xml2.des.state.nh.us/DWTool/](https://xml2.des.state.nh.us/DWTool/).

For more information about the Targeted Arsenic and Uranium Study Public Health Study, contact Amanda Cosser at (603)-271-4611 or visit [http://www.dhhs.nh.gov/dhhs/lab/targetedarsenicanduraniumstudy.htm](http://www.dhhs.nh.gov/dhhs/lab/targetedarsenicanduraniumstudy.htm)

References

Results Summary

<table>
<thead>
<tr>
<th>Routine Analysis</th>
<th>Water Test Value Entered</th>
<th>Drinking Water Contaminant Limit</th>
<th>About Your Well Water?</th>
</tr>
</thead>
<tbody>
<tr>
<td>☑️ arsenic</td>
<td>0.004 mg/L</td>
<td>0.01 mg/L</td>
<td>The value entered meets the drinking water standard</td>
</tr>
<tr>
<td>☑️ chloride</td>
<td>5 mg/L</td>
<td>250 mg/L</td>
<td>The value entered meets the drinking water standard</td>
</tr>
<tr>
<td>☑️ copper</td>
<td>0.001 mg/L</td>
<td>1.3 mg/L</td>
<td>The value entered meets the drinking water standard</td>
</tr>
<tr>
<td>☑️ fluoride</td>
<td>0.41 mg/L</td>
<td>2 mg/L</td>
<td>The value entered meets the drinking water standard</td>
</tr>
<tr>
<td>☑️ hardness</td>
<td>35 mg/L</td>
<td>-</td>
<td>There is no drinking water guideline or standard</td>
</tr>
<tr>
<td>☑️ iron</td>
<td>0.197 mg/L</td>
<td>0.3 mg/L</td>
<td>The value entered meets the drinking water standard</td>
</tr>
<tr>
<td>☑️ lead</td>
<td>0.0009 mg/L</td>
<td>0.015 mg/L</td>
<td>The value entered meets the drinking water standard</td>
</tr>
<tr>
<td>✗ manganese</td>
<td>0.192 mg/L</td>
<td>0.05 mg/L</td>
<td>The value entered exceeds the drinking water guideline</td>
</tr>
<tr>
<td>☑️ nitrate-N</td>
<td>0.09 mg/L</td>
<td>10 mg/L</td>
<td>The value entered meets the drinking water standard</td>
</tr>
<tr>
<td>☑️ nitrite-N</td>
<td>0.009 mg/L</td>
<td>1 mg/L</td>
<td>The value entered meets the drinking water standard</td>
</tr>
</tbody>
</table>
Reporting & Community Meetings

- Water results in real time
- Urine results at conclusion
- Result interpretation aid to be offered
- Community meetings
Next Steps

- Continue recruitment and testing for Targeted As/U Study- Summer 2017
- Environmental Public Health Tracking (EPHT) Wisdom data dissemination
- Continue partnership with Dartmouth Primary Care Research Network to disseminate water kits
- Surveillance Project to study NH specific NHANES data to begin Fall 2017
Biomonitoring New Hampshire

Contact Information:
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James Chithalen, Program Manager   603 271-4450
Amanda Cosser, Epidemiologist       603 271-4611
John Schneider, Toxicologist       603 271-8084

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Concord, New Hampshire 03301
Ken Aldous
New York State Department of Health
Biomonitoring: Measuring Chemicals in People

NCSL Webinar - June 30, 2017

Kenneth M. Aldous, PhD

Division of Environmental Health Sciences
Wadsworth Center
NY State Department of Health
Chemicals are woven into the very fabric of our lives
The Need for State Level Biomonitoring Capacity

• CDC:
  • uses biomonitoring to conduct an ongoing assessment of the U.S. population’s exposure to more than 300 environmental chemicals (NHANES).
  • NHANES data provide nationally representative reference ranges, but **do not provide exposure information by specific state** or locality.

• States Public Health Labs:
  • need the capacity to perform testing for local community investigations of current environmental chemical exposure.
  • Characterize and monitor exposures of communities to current and emerging environmental chemicals.
Biomonitoring and Emergency Response
Laboratory Response Network (LRN)

- Most State Public Health Labs are part of the LRN
- LRN is funded through CDC preparedness program.
- There exists infrastructure and nascent capacity for biomonitoring studies to be undertaken in collaboration with state Environmental Health partners.
- NY has applied the existing LRN-Chemical (LRN-C) infrastructure to respond quickly to emerging issues involving public exposure to chemical contaminants.
Laboratory Response Network (LRN-C) and Public Health Response

What constitutes a LRN-C Laboratory?

- LRN-C infrastructure, assets + prepared.
  - Skilled analysts – method development
  - Analytical instrumentation
  - Biological sample logistics
  - Sample collection and shipping
  - Automated sample processing
  - CLIA Compliant Testing
  - Surge capacity training
  - Rapid results reporting
  - Outreach to emergency responders
NY State Public Health Lab

Response to Communities with Emerging Contaminants in Drinking Water.

PFOA, PFOS

PFAS  Perfluoroalkyl Substances
Public Health - Biomonitoring

- Intense public interest in body burden assessment
- PFAS included in NHANES biomonitoring (national reference ranges)
- Provide public health service, with accurate and defensible data (CLIA compliant), to NYS residents
- Biomonitoring database for evaluation of remedial actions.
- Improve outreach/partnerships with public hospitals and Public Service Centers within NYS for data transfer
- Assist neighboring states through sample testing (NH and VT) or disseminating knowledge (MA)
2016 - Hoosick Falls, NY
Public Water Supply – PFOA contamination

- The Village of Hoosick Falls is located in the Town of Hoosick, a rural community located in northeastern Rensselaer County, about 30 miles from Albany. The Town has a population of 6,700 with 3600 living in the Village.

- The raw water in the 3 Municipal Wells have tested at ranges between 150ng/L to 662ng/L of PFOA. Contamination was from a Plastics Fabrication Company located in the village.
June 30, 2017

Hoosick Falls
Installation of Carbon Filtration System

GAC Filter reduced the PFOA Level to <2 ng/L in Public Water supply

EPA health advisory set at 70ng/L for Σ(PFOA+PFOS)
Newburgh NY on the Hudson River

Population 28,000 – Fire Fighting Foam
Drinking Water PFAS Profiles

Newburgh water impacted mainly by Fire Fighting Foam

Hoosick Falls - PFOA
Well contamination from a Plastics Manufacturing Plant
Public Health Lab Role

Exposure Assessment

Biomonitoring

Blood Collection
LRN-C and High Throughput Capability

- Serum Testing offered to Hoosick Falls Residents (3,500 village + 3,100 town - using private wells).
- Requested to leverage LRN-C expertise and surge capacity to develop rapid, CLIA compliant biomonitoring capability for PFOA.
- 2,081 serum samples were analyzed in a ~8 weeks.
- Method for 11 PFAS targets was developed in parallel and also validated to CLIA standards for emerging issues at other NY and States water supplies.
- Projected workload would increase and data processing and sample collection required alternative solutions.
Components of a High-Throughput Method

Key components of each biomonitoring project involve sections of the Public Health organization working together to allow efficient sample flow consistent with maintaining data quality.

- Trained staff with sampling equipment pre-checked for contamination available at collection site.
- Data entry for sample analysis request forms
- Sample collection and transport to laboratory
- Rapid robust instrumental analytical procedures
- Approved Standard Operating Procedures (SOPs)
- Efficient Analytical Data review and reporting
- Secure Data reporting (clinical sample reports)
Results of Serum Analysis
# Data Summary of Blood Test Results for People Tested February–April 2016

<table>
<thead>
<tr>
<th># of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total (including children)</td>
</tr>
<tr>
<td>Total adults (age 18 and over)</td>
</tr>
<tr>
<td>Adults who drank Village water</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Totals by gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>Females</td>
</tr>
<tr>
<td>Males</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Totals by age group</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-17</td>
</tr>
<tr>
<td>18-39</td>
</tr>
<tr>
<td>40-59</td>
</tr>
<tr>
<td>60 and older</td>
</tr>
</tbody>
</table>

Hoosick Falls Samples
PFOA Blood Levels of Hoosick Residents Compared to Residents from Other Communities

PFOA level in Blood:
Hoosick 50th Percentile Compared to US Population and Other Community Studies of Public Water Supplies
(Micrograms per Liter)

- Little Hocking, OH: 228
- Lubeck, WV: 92
- People on Hoosick Falls Public Water: 64.2
- Tuppers Plains, OH: 42
- Total Hoosick Falls area: 28.3
- Mason County, WV: 16
- US Population: 2.1
Adults using village water – levels are 50th percentiles
## Data Summary for Children on By Age Group and Drinking Water Source

<table>
<thead>
<tr>
<th># of Participants</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>All children</td>
<td>353</td>
</tr>
<tr>
<td><strong>By Age Groups</strong></td>
<td></td>
</tr>
<tr>
<td>Younger than age 12</td>
<td>199</td>
</tr>
<tr>
<td>Ages 12-17</td>
<td>154</td>
</tr>
<tr>
<td><strong>By Drinking Water Source</strong></td>
<td></td>
</tr>
<tr>
<td>Currently served by Village public water</td>
<td>212</td>
</tr>
<tr>
<td>Formerly served by Village public water</td>
<td>55</td>
</tr>
<tr>
<td>Never served by Village public water</td>
<td>86</td>
</tr>
<tr>
<td><strong>Currently Served by Village Public Water by Age Group</strong></td>
<td></td>
</tr>
<tr>
<td>Younger than age 6</td>
<td>38</td>
</tr>
<tr>
<td>Ages 6 to 10</td>
<td>64</td>
</tr>
<tr>
<td>Ages 11 to 17</td>
<td>110</td>
</tr>
</tbody>
</table>

### PFOA Blood Test Results for All Children by Drinking Water Source (Micrograms per Liter)

- Currently served by Hoosick Falls public water: 33.8
- Formerly served by Hoosick Falls public water: 12
- Never served by Hoosick Falls public water: 5.2
Ongoing Work

• Continue monitoring of Drinking Water
  – Effectiveness of Carbon Filtration
• Serum Testing for additional impacted NY locations
• Repeat serum testing to document effects of remediation and reduced exposure.
• Identify other priority Public Water Supply emerging contaminants.
• Report on each project findings ongoing method development
Thank You

Contact Information
Email: kenneth.aldous@health.ny.gov
Phone: (518) 474-7161
Archived Webinar
Slides and a recording of today's event will be made available within 5 business days at http://www.ncsl.org/default.aspx?tabid=31413.

Register for additional webinars at the address above.

Questions?
Contact Gretchen.DuBois@ncsl.org

Thank you for attending!