Public Drinking Water

New Hampshire Health Officers Association
May 18, 2016

Chip Mackey
Drinking Water Quality Manager
NH Department of Environmental Services
Drinking Water and Groundwater Bureau
• Drinking Water Groundwater Bureau

• What is a Public Water System?

• Drinking Water Standards

• Communications

• Public Notices
Drinking Water & Groundwater Bureau

- Implement SDWA
- Financial Aid
- Technical Assistance
- Emergency situations (i.e. droughts, chemical spills, vandalism)
- Perform inspections (sanitary surveys)
Drinking Water & Groundwater Bureau

- Sampling
- Certify Operators
- Education
- Approve System Changes/Designs
- Enforcement Actions
Public Water System

“a piped water system having it’s source of supply, serving 15 or more service connections, or 25 or more people for 60 or more days a year”
Community Systems

- Municipal
- Apartments / Condominiums
- Mobile home parks
- Single family home developments

❖ Have a certified operator
Non-transient/Non-community Systems

- Schools / Daycares
- Office buildings
- Hospitals
- Businesses with permanent employees

- Have a certified operator
Transient Systems

- Restaurants
- Hotels / Motels
- Campgrounds
- Beaches / Ski Areas
- Convenience Stores

*No operator required*
NH by the Numbers

- 2496 public water systems
  - 722 community
  - 455 non-transient/non-community
  - 1319 transient

- 20th most in US
  - 43rd population
  - 46th in area
Drinking Water Standards

Primary Standards
» Health Based
» Enforceable

Secondary Standards
» Aesthetic
» Generally Not Enforced
Primary Standards

- Acute Contaminants
- Chronic Contaminants
Acute Health Effects

- Short Term Exposure or High Dose
- Illness occurs quickly
- May be life threatening

- Microbiological
- Nitrate
Acute – Microbiological
Common Waterborne Diseases

- Gastroenteritis
- Salmonella
- Giardiasis
- Cryptosporidiosis
- Legionnaire’s Disease
- Hepatitis
- Dysentery
- Typhoid Fever
- Cholera
Total Coliform Bacteria

- Coliform Bacteria are found in warm blooded animals.

- *E. coli* is a subset of coliform and may be pathogenic.
Human Microbiome

Human Body Composition:

- 10 Trillion Human Cells
- 100 Trillion Bacteria
  - (accounting for 1–3% of total body mass)

Bacterial Species Living in Humans:

- 5,000-35,000 intestine
- 300-500 mouth
- 120 skin
- 100 Pathogenic Species
Health effects of *E. coli*

- Severe abdominal cramping.
- Vomiting
- Diarrhea (Bloody or non-bloody)
- Appear from within hours to up to 10 days
Health effects of *E. coli*? 

- Frequently, no fever is present.

- No cure, in most cases, symptoms clear up on their own within 5 to 10 days.

- Some people show no symptoms, but still carry and pass it on.
E. coli Strain O157:H7

- People who suffer *E. coli* O157:H7 poisoning face a 30 per cent higher risk of high blood pressure or kidney damage

- In a small number of cases, contamination can lead to hemolytic uremic syndrome (HUS)
HUS

- Life-threatening condition
- Necessitates hospitalization - ICU
- Kills three to five percent of people
- Some who recover have lifelong complications including blindness, paralysis and kidney failure
Walkerton, ONT

2000 – *E. coli* outbreak

- 2300 sick (1/2 town’s population)
- 65 hospitalized
- 7 died

*E. coli* O157:H7 contamination in a shallow well
2015 – Boil Water Advisories

- 31 Boil Orders
- 23,988 routine samples
- 662 positive total coliform
- 23 positive for total *E. coli*
Acute – Nitrate/Nitrite

- Methemoglobinemia (Blue Baby Syndrome)
- Also Chronic Health Effects
  - Cancers
  - Developmental Effects
  - Hypothyroidism
Blue Baby Syndrome

- Fetuses & Infants (<6 months)
- Hemoglobin is converted to methemoglobin
  - Inhibits the blood’s ability to carry oxygen
- Bluish skin and lips
- Hypotension, rapid pulse and breathing
- Can be fatal
2015 - Do Not Drink Advisories

- 2986 Routine Nitrate Samples
- 1046 Detections
- 4 Do Not Drink Advisories
Response to Exceedances of Acute Contaminants

- Lab notify the water system and DES ASAP (within 24 hours)

- System issue Drinking Water Advisory ASAP (within 24 hours)
  - Boil Water Order
  - Do Not Drink
Chronic Health Effects

- Long Term Exposure or Low Dose
- Illness due to a lifetime exposure.

- IOC
- VOC
- SOC
- Radionuclides
Examples of Chronic Health Effects

- **Arsenic**: Skin, Circulatory, Carcinogen
- **Barium**: Muscle weakness, increased blood pressure
- **Copper**: Gastrointestinal, Liver, & Kidney effects
- **Lead**: Delays in Physical & Mental Development
- **Uranium**: Carcinogen, Kidney Problems
- **TTHMs**: Carcinogen
- **Phthalates**: Carcinogen, Liver, Reproductive Problems
- **MtBE**: Carcinogen, Liver, Kidney
Response to Exceedances of Chronic Contaminants

- Lab report the results to water system and DES (within 2 business days)

- System issue Public Notice (within 30 days)
Establishing Standards

- Unregulated Contaminant Monitoring Rules (UCMR)
  - Contaminant Candidate List (CCL)

- Selection based on sound science
  - Best available, peer-reviewed science and supporting studies

- Lifetime Exposure
  - Consume 2 liters/day at MCL for 70 years
  - Take into account other sources
Establishing Standards

- Occurrence information
- Public Involvement
- Cost-benefit analysis
  - Affordable technologies
  - Small system technologies
LADIES

If you desire a transparent, CLEAR, FRESH complexion, free from blotch, blemish, roughness, coarseness, redness, freckles, or pimples, use

DR. CAMPBELL’S
SAFE ARSENIC COMPLEXION WAFERS

AND

Fould’s Medicated Arsenic Complexion Soap.

The only real true beautifiers in the world. Warranted to give satisfaction in every case or money refunded. Wafers by mail, $1; six large boxes, $5. Soap, per cake, 50 cents.

Address, H. B. Fould, 214 Sixth Avenue, New York.

SOLD BY DRUGGISTS EVERYWHERE.
Arsenic

- IOC
- No taste, color, or odor
- Cancer
  - Lung, Bladder, Skin
  - Kidney, Liver, & Prostrate
- Circulatory issues
- 50ppb (old standard)
  - Estimated risk 3 in 1,000
Arsenic Exposure Pathways

- Ingestion - yes
- Inhalation - no
  - *Except cigarettes*
- Absorption – no
Daily Arsenic Exposure

- US diet - 8-14 ug/day
  - Meat
  - Fish
  - Poultry
  - Grains
  - Rice

Cigarettes, about 10 ug/pack
Ingestion while playing in bath

- Young child - up to 10 ug/day exposure acceptable
  - 2 oz. water @ 170 ppb = 10 ug
  - 3.5 oz. water @ 100 ppb = 10 ug
  - 13.5 oz. water @ 25 ppb = 10 ug
### Drinking Water Cancer Risks – Exposure at or Above MCL Options  
(Adjusted for Exposure in Food & Cooking Water)

<table>
<thead>
<tr>
<th>MCL (μg/L)</th>
<th>Mean Exposed Population Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>11 - 13 in 1,000,000</td>
</tr>
<tr>
<td>5</td>
<td>27 - 32 in 1,000,000</td>
</tr>
<tr>
<td>10</td>
<td>63 - 76 in 1,000,000</td>
</tr>
<tr>
<td>20</td>
<td>111 – 135 in 1,000,000</td>
</tr>
<tr>
<td>50 (old standard)</td>
<td>3000 in 1,000,000</td>
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</table>
## Estimated Annual Cost for Reducing Arsenic vs Total Cancer Health Benefits (in $millions)

<table>
<thead>
<tr>
<th>MCL (ug/L)</th>
<th>Total Annual Cost</th>
<th>Total Annual Health Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>$792.1</td>
<td>$213.8 - $490.9</td>
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<tr>
<td>5</td>
<td>$471.7</td>
<td>$191.1 - $355.6</td>
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<tr>
<td>10</td>
<td>$205.6</td>
<td>$139.6 - $197.7</td>
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<tr>
<td>20</td>
<td>$76.5</td>
<td>$66.2 - $75.3</td>
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</table>
SDWA Standard for Arsenic

**Effective January 23, 2006

10 ug/L
Communication

• From DES
  – Drinking Water Advisory
    • Presence of an Acute Contaminant
    • Potential for Acute contamination
  – Enforcement Actions
    • Letter of Deficiency
    • Order / Fine
  – Help with unresolved complaint or health concern
Communication

- From You
  - PWS Out of Water
  - Potential Public Water System
  - PWS Complaint
Elements of a Public Notice

- Description of violation or situation
- When violation or situation occurred
- Potential health effects
- Population at risk
- Whether alternate water supplies should be used
- Actions consumers should take
- Corrective actions being taken
- When PWS will resolve problem
- Name, number, and address for additional information
- Standard distribution language
They depend on us.
Questions!?!  

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We are what we repeatedly do. Excellence then is not an act but a habit. - Aristotle