BST: Relevance to EPA Policies, Programs and Regulations

2012 BST Conference
State-of-the-Science
New Braunfels, Texas

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Cincinnati, Ohio
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U.S. Environmental Protection Agency
Sustainability Context
Sustainability Advancement Opportunity

- Beach Closed
- Do Not Enter
- Boil Advisory
- About 34.9 bgd Municipal Effluent in the U.S.
  - 5–6% Reclaimed
- Tractor spraying reclaimed water

Pie chart showing 5–6% reclaimed water.
Statutory Frameworks

• Federal Clean Water Act
  – Water quality standards
  – Total Maximum Daily Loads
  – Biosolids management
  – Water reuse

• Federal Safe Drinking Water Act
  – Source water protection
  – Control of contaminants
U.S. Recreational Waterborne Disease Outbreaks (AGI) 1999-2008

MMWR, Sept. 23, 2011 /60(ss12);38-68
Water Quality Standards

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CWA Water Quality Standards Elements

- Waterbody use designation
- Criteria (numeric or narrative)
- Antidegradation
U.S. Rivers and Streams Assessment Status and Quality

- All Rivers and Streams:
  - Assessed: 27%
  - Unassessed: 73%
  - 3,533,205 Miles of Rivers and Streams

- Assessed Rivers and Streams:
  - Good: 46%
  - Impaired: 53%
  - Threatened: 1%
  - 570,781 Miles of Assessed Rivers and Streams

<table>
<thead>
<tr>
<th>Assessed Status</th>
<th>Miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessed</td>
<td>970,781</td>
</tr>
<tr>
<td>Unassessed</td>
<td>2,562,424</td>
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<tr>
<td>Total Miles</td>
<td>3,533,205</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Attainment Status</th>
<th>Miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>449,617</td>
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<tr>
<td>Threatened</td>
<td>6,369</td>
</tr>
<tr>
<td>Impaired</td>
<td>514,795</td>
</tr>
<tr>
<td>Total Miles Assessed</td>
<td>970,781</td>
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</tbody>
</table>
NRDC v. EPA (2006)

- NRDC sued EPA on its lack of progress to comply with BEACH Act requirements
- Issues
  - Timetable for proposing new standards
  - Setting standards that fully protect public health
  - Establishing test methods to allow prompt decision making about beach closings and advisories
Total Maximum Daily Loads

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U.S. Rivers and Streams
Designated Use Condition

<table>
<thead>
<tr>
<th>Designated Use Group</th>
<th>Miles Assessed</th>
<th>Percent Good</th>
<th>Percent Threatened</th>
<th>Percent Impaired</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish, Shellfish, And Wildlife Protection And Propagation</td>
<td>762,113</td>
<td>55.0</td>
<td>.5</td>
<td>44.5</td>
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<tr>
<td>Recreation</td>
<td>390,603</td>
<td>55.2</td>
<td>1.4</td>
<td>43.3</td>
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<tr>
<td>Agricultural</td>
<td>351,971</td>
<td>93.7</td>
<td>.6</td>
<td>5.8</td>
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<tr>
<td>Aquatic Life Harvesting</td>
<td>261,832</td>
<td>34.0</td>
<td>.3</td>
<td>55.7</td>
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<tr>
<td>Industrial</td>
<td>210,190</td>
<td>93.3</td>
<td>.0</td>
<td>6.7</td>
</tr>
<tr>
<td>Public Water Supply</td>
<td>187,707</td>
<td>73.9</td>
<td>.8</td>
<td>25.3</td>
</tr>
<tr>
<td>Other</td>
<td>99,546</td>
<td>84.5</td>
<td>.3</td>
<td>15.3</td>
</tr>
<tr>
<td>Aesthetic Value</td>
<td>26,064</td>
<td>89.0</td>
<td>.0</td>
<td>11.0</td>
</tr>
<tr>
<td>Exceptional Recreational Or Ecological Significance</td>
<td>14,563</td>
<td>11.3</td>
<td>4.4</td>
<td>84.4</td>
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</tbody>
</table>
## U.S. Rivers and Streams
Designated Impaired for Pathogens Cause

<table>
<thead>
<tr>
<th>Cause of Impairment</th>
<th>Miles Threatened or Impaired</th>
</tr>
</thead>
<tbody>
<tr>
<td>Escherichia Coli (E. Coli)</td>
<td>70,849</td>
</tr>
<tr>
<td>Fecal Coliform</td>
<td>66,874</td>
</tr>
<tr>
<td>Pathogens</td>
<td>10,916</td>
</tr>
<tr>
<td>Enterococcus Bacteria</td>
<td>9,029</td>
</tr>
<tr>
<td>Bacteria</td>
<td>7,347</td>
</tr>
<tr>
<td>Total Coliform</td>
<td>3,571</td>
</tr>
<tr>
<td>Fecal Bacteria</td>
<td>108</td>
</tr>
<tr>
<td>Indicator Bacteria</td>
<td>64</td>
</tr>
<tr>
<td>Bacterial Slimes</td>
<td>30</td>
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</table>
Biosolids Management

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Biosolids

• EPA has approved the following microbial methods for use in biosolids: EPA Method 1680 and 1681 for fecal coliforms and EPA Method 1682 for Salmonella.

• All approved methods use culture techniques
Water Re-use

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About 5-6% of municipal wastewater effluent in the U.S. is reclaimed and beneficially reused.

- Israel reuses more than 70%.
- Singapore reuses 30%, up from 15% in recent years.
- Australia, now at 8%, has a national goal of 30% by 2015.
CWA Analytical Methods

- Approved EPA methods mandatory for CWA compliance activities

- Approved Methods codified in 40 CFR 136
CWA Approved Methods
40 CFR 136

• 1603 Escherichia coli (E. coli) in Water by Membrane Filtration Using Modified membrane-Thermotolerant Escherichia coli Agar (Modified mTEC)
• 1604 Total Coliforms and Escherichia coli in Water by Membrane Filtration Using a Simultaneous Detection Technique (MI Medium) (PDF)
• 1605 Aeromonas in Finished Water by Membrane Filtration using Ampicillin-Dextrin Agar with Vancomycin (ADA-V) (PDF)
• 1622 Cryptosporidium in Water by Filtration/ Immunomagnetic Separation/Immunofluorescence Assay Microscopy
• 1623 Cryptosporidium and Giardia in Water by Filtration/IMS/FA
Other CWA Methods not Currently Approved for use at 40 CFR 136

• *Escherichia coli (E. coli)* in Water by Membrane Filtration
  – 1103.1 Using membrane-Thermotolerant *Escherichia coli Agar* (mTEC)
  – 1603 Modified membrane-Thermotolerant *Escherichia coli Agar* (Modified mTEC)

• *Enterococci in Water*
  – 1106.1 Using membrane-Enterococcus-Esculin Iron Agar (mE-EIA)
  – 1600 By Membrane Filter Test Method for Enterococci in Water

• Male-specific (F+) and Somatic Coliphage in Water
  – 1601 By Two-step Enrichment Procedure (PDF) (40 pp, 259K)
  – 1602 By Single Agar Layer (SAL) Procedure (PDF) (38 pp, 207K)

• 1604 Total Coliforms and *Escherichia coli* in Water by Membrane Filtration Using a Simultaneous Detection Technique (MI Medium) (PDF) (18 pp, 384K)

• 1605 *Aeromonas in Finished Water* by Membrane Filtration using Ampicillin-Dextrin Agar with Vancomycin (ADA-V) (PDF) (36 pp, 141K)

• 1622 *Cryptosporidium in Water* by Filtration/Immunomagnetic Separation/Immunofluorescence Assay Microscopy

• 1623 *Cryptosporidium and Giardia in Water* by Filtration/IMS/FA
U. S. Drinking Waterborne Disease Outbreaks

MMWR, Sept. 23, 2011 /60(ss12);38-68
Drinking Water Safety

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At each stage, need increased specificity and confidence in the type of supporting data used (e.g. health, occurrence, treatment).
### National Public Drinking Water Regulations

#### Microorganisms

<table>
<thead>
<tr>
<th>Contaminant</th>
<th>MCLG&lt;sup&gt;1&lt;/sup&gt; (mg/L)&lt;sup&gt;2&lt;/sup&gt;</th>
<th>MCL or TT&lt;sup&gt;1&lt;/sup&gt; (mg/L)&lt;sup&gt;2&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Cryptosporidium</em></td>
<td>zero</td>
<td>TT&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td><em>Giardia lamblia</em></td>
<td>zero</td>
<td>TT&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td>HPC</td>
<td>n/a</td>
<td>TT&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td><em>Legionella</em></td>
<td>zero</td>
<td>TT&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Total Coliforms (including fecal coliform and <em>E. Coli</em>)</strong></td>
<td>zero</td>
<td>5.0%&lt;sup&gt;4&lt;/sup&gt;</td>
</tr>
<tr>
<td>Turbidity</td>
<td>n/a</td>
<td>TT&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td>Viruses (enteric)</td>
<td>zero</td>
<td>TT&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
</tbody>
</table>
Homeland Security/Emergency Response

BST Relevance
Water Security/Emergency Response
Using Microbial Source Tracking to Support TMDL Development and Implementation

April 2011

Prepared for:
U.S. Environmental Protection Agency, Region 10

Prepared by:

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Scottsbluff, NE 69361

April 2011
“A New Hope”

Technology Innovation Clusters and New Technology Development
Water Market Segments - 2008

Global: $425 billion

- Water test Residential: $5
- Other water markets: $22
- Pumps: $29
- Valves: $44
- Infrastructure: $46
- Industrial water treatment: $95
- Water and wastewater treatment: $164

US: $95 billion

- Water test Residential: $2
- Other water markets: $6
- Pumps: $8
- Valves: $5
- Infrastructure: $13
- Industrial water treatment: $9
- Water and wastewater treatment: $27

Source: Goldman Sachs Research estimates.
Newly developed **Microbial Source Tracking** methods for distinguishing human, cattle, and chicken sources of fecal contamination

**Genome Fragment Enrichment** DNA sorting technology to identify unique and divergent sequences between two DNA preparations
SBIR Pathogen Technology Development Investment
Acknowledgements

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