Indicator bacteria:
Deer Island disinfection and dilution at outfall protect Mass Bay

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Wastewater Advisory Committee
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48% of all tests were non-detects

99th percentile was 131 CFU/100mL

Maximum was 501 CFU/100mL

No permit violations 2008-16 (only violations were in 12/2001 and 4/2004)
Current Massachusetts marine receiving water Enterococcus standards:
- Geometric mean: 35 col/100mL
- Single sample: 104 col/100mL

Potential limits for effluent, using 70-fold dilution factor:

<table>
<thead>
<tr>
<th>Geometric mean</th>
<th>Single sample</th>
<th>Current standard</th>
<th>Dilution factor</th>
<th>Enterococcus limit</th>
</tr>
</thead>
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<tr>
<td>35 col/100mL</td>
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<td>X 70</td>
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<td>= 2,450 col/100mL</td>
<td>= 7,280 col/100mL</td>
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Deer Island: *Enterococcus* by month, 2008-16

Distribution plot of single *Enterococcus* samples from 2008-2016, by month

**Strong seasonal pattern:**
- high in late winter and early spring
- low in late summer and early fall
Deer Island: *Enterococcus* by monthly geometric mean, 2008-16

Monthly geometric means, 2008-2016

All years show same seasonal pattern
Mass Bay: *Enterococcus* annual mean results

Similar results to Fecal coliform:
- Vast majority (91%) of samples are non-detects
- Annual means well below swimming standard
- Similar results for outfall, nearfield, and coastal stations
- Similar results for Adverse and Conditional surveys
Synthesis: Counts in effluent and receiving waters, 2008-16

Effluent:
- Strongly seasonal
- Peak in late winter

Receiving waters:
- Very low levels
- Vast majority non-detects
- Not seasonal like effluent

ND = Not detected in Feb 2008-2016
Implications: Managing effluent *Enterococcus* levels

- Cannot increase contact time
- Increased chlorination?
- Seasonal limits?
Implications: Side effects of increased chlorination

• Possible increased toxicity
  – Permit requires monthly toxicity tests

• Increased chemical costs

• Increased truck traffic through Winthrop for chemical delivery
  – Higher chance of accidents
  – Increased traffic congestion
  – Higher greenhouse gas emissions
  – Unhappy neighbors
**Final conclusions**

- **Effluent at Deer Island:**
  - Fecal coliform: very low and in full compliance
  - *Enterococcus*: not yet regulated, but...
    - Strongly seasonal with high levels in late winter
    - If/when regulated, may require operational changes

- **Mass Bay**
  - Both fecal coliform and *Enterococcus* levels have met water quality standards very consistently year-round
  - Outfall has very minor influence

- **Potential operational changes would have negative consequences with likely little impact on protection of receiving waters**
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