January 12, 2009

Mr. Glenn Haas, Acting Commissioner  
Division of Watershed Management  
Department of Environmental Protection  
1 Winter Street  
Boston, MA 02108

Mr. Stephen Perkins, Director  
Office of Ecosystem Protection  
U.S. Environmental Protection Agency  
Water Technical Unit “SEW”  
P.O. Box 8127  
Boston, MA 02114

Re: Massachusetts Water Resources Authority, Permit Number MA0103284  
Part I.7 Quarterly Ambient Monitoring Report

Dear Mr. Haas and Mr. Perkins:

There are no interpretative reports on MWRA’s ambient monitoring program to submit for this quarter.\(^1\) The quarterly ambient monitoring summary report that is required in the Contingency Plan is attached.

MWRA will provide raw monitoring data upon request. Please let me know if any of MWRA's staff can give you additional assistance regarding these reports.

Sincerely,

Michael J. Hornbrook  
Chief Operating Officer

\(^1\) Part I.7.c.iv of the permit requires “The results of all monitoring required by the ambient monitoring plan or the eutrophication model shall be reported to EPA, MADEP, OMSAP and NMFS, on a quarterly basis.”
cc:
Environmental Protection Agency, Region I (EPA)
Matthew Liebman
Todd J. Borci
Roger Janson (cover letter only)

Massachusetts Department of Environmental Protection (DEP)
Cathy Vakalopoulos

Outfall Monitoring Science Advisory Panel
Andrew Solow
Robert Beardsley
Norb Jaworski
Scott Nixon
Judy Pederson
Michael Shiaris
James Shine
Juanita Urban-Rich
Robert Kenney

National Marine Fisheries Service
Chris Mantzaris

Stellwagen Bank National Marine Sanctuary
Craig MacDonald

EOEA
Kathy Baskin

Hyannis Library
Ann-Louise Harries

MWRA Library
Mary Lydon

Public Interest Advisory Committee
Patty Foley (cover letter only)

Cape Cod Commission
Tom Cambareri (cover letter only)
Ambient Monitoring

MWRA gathers data from the outfall location in Massachusetts Bay on various thresholds in its Deer Island outfall discharge permit. This report shows relevant ambient monitoring results that became available in the October-December 2008 time period. There are updated data relevant to the nuisance alga *Alexandrium*, for which partial results were reported last quarter. There are no new contingency plan threshold exceedances.

**DISSOLVED OXYGEN (DO) – late September-October 2008**

Measurements of dissolved oxygen (DO) concentration and percent saturation in late fall 2008 did not fall below background levels and thus did not exceed thresholds.

The current reporting period for dissolved oxygen thresholds is late September-October 2008. During this period there were two nearfield surveys and one farfield survey. Oxygen levels were similar to those seen in most baseline years. The graphs above include data since the start of the monitoring program in 1992, and reflect the natural fluctuation of DO and percent saturation, which are typically lowest in early autumn.
DO Depletion Rate – summer 2008

An additional threshold measure of dissolved oxygen is the rate at which oxygen is depleted during the stratified summer period. The current reporting period for oxygen depletion rate is summer 2008, defined as June - October. The DO depletion rate for the summer of 2008 was low and did not exceed the threshold.

![Graph showing DO depletion rate from 1992 to 2008](image)

Even if dissolved oxygen concentrations remain healthy, an excessively rapid rate of decrease could signal a future problem. A low rate indicates DO dropped only slowly. The threshold for DO depletion rate is based on a change from the baseline rate; the caution threshold is a rate faster than 1.5 times the baseline mean rate, while the warning threshold is twice the baseline mean rate.

CHLOROPHYLL – May-August 2008

There were no chlorophyll threshold exceedances in this period. The nearfield mean areal average chlorophyll in summer 2008 was 42 mg/m², below the caution level threshold for summer of 93 mg/m².

The figure compares chlorophyll data for summer 2008 (May-August), which included four surveys, to the corresponding threshold. The graph includes data since the start of the monitoring program in 1992.

Summer

![Graph showing summer chlorophyll from 1992 to 2008](image)
NUISANCE ALGAE – SUMMER 2008

In the figures below, we compare *Phaeocystis* and *Pseudonitzschia* data to the nuisance algae thresholds for summer 2008 (May through August), which included four surveys. We also compare *Alexandrium* data to the threshold for each sample in July through August 2008.

There were no threshold exceedances for *Phaeocystis*, *Pseudonitzschia*, or *Alexandrium*.

**PHAEOCYSTIS and PSEUDONITZSCHIA**

The large spring bloom of *Phaeocystis pouchetii* in the Gulf of Maine did not persist into the summer season, and *Pseudonitzschia* was observed only at very low levels in the nearfield in summer 2008. *Pseudonitzschia* was not observed in the nearfield in summer 2008.

**PHAEOCYSTIS, Summer**

Note logarithmic scale. Years with no data point had zero summer average *Phaeocystis*.

**PSEUDONITZSCHIA, Summer**

Note logarithmic scale. Years with no data point had zero summer average *Pseudonitzschia*.
**ALEXANDRIUM**

The nuisance algae *Alexandrium* ("red tide") can cause paralytic shellfish poisoning (PSP) in Massachusetts Bay. MWRA measures *Alexandrium* abundance in its monitoring program, and also checks state fisheries agency observations of shellfish PSP toxicity to keep track of the course of Gulf of Maine *Alexandrium* blooms.

In 2008 there was an *Alexandrium* bloom along the coast of Maine, New Hampshire, and Massachusetts. Early data, using rapid molecular DNA probe methodologies from a special survey on May 16 and a routine survey on May 21, showed that the single sample abundance of *Alexandrium* in the outfall nearfield exceeded the Caution Level threshold of 100 cells/L, triggering notification under the Contingency Plan (see [http://www.mwra.state.ma.us/harbor/pdf/20080516amx.pdf](http://www.mwra.state.ma.us/harbor/pdf/20080516amx.pdf)). By late June 2008, the bloom had subsided in Massachusetts Bay. The peak abundance of algae in 2008 in western Massachusetts Bay was similar to that of the 2005 bloom, but the bloom was less widespread and lasted a shorter time in Massachusetts waters compared to 2005. However, unlike 2005, there were high levels of *Alexandrium* in Boston Harbor which led to closing of shellfish beds there.

The figure below includes nearfield data available through December 2008, including data from routine surveys through August 2008, from special rapid DNA probe samples taken from three of the routine surveys and from four special surveys in May and June 2008, and from special targeted surveys during the bloom. Most of these data have been reported in previous quarterly reports; the new information includes July-August 2008, plus routine surveys in June 2008. (Note logarithmic scale for graph.)

![Graph of *Alexandrium* per-sample abundance](image.png)

<table>
<thead>
<tr>
<th>July-August <em>Alexandrium</em> per-sample abundance (cells/liter)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caution threshold</td>
</tr>
<tr>
<td>100</td>
</tr>
<tr>
<td>Summer 2008</td>
</tr>
<tr>
<td>0*</td>
</tr>
</tbody>
</table>

* maximum of all samples collected between July 1, 2008 and August 31, 2008

Legend:
- pre-discharge
- discharge
- caution level
The annual survey of sediment-dwelling communities in 2008 showed that the benthic diversity was normal at the outfall site, and did not exceed any of the benthic diversity thresholds.

For each diversity measure, the graphs show the annual average for sediment samples collected within seven kilometers of the outfall discharge since 1992. No data are shown for 2005 and 2007 because a different set of stations was sampled in those years.

**OPPORTUNISTS**

The annual sampling in 2008 showed that the numbers of opportunistic benthic organisms remain normal at the outfall site and did not exceed the caution threshold of 10% of the total population.
The 2008 annual sediment monitoring showed that the RPD depth was normal at the outfall site and did not exceed the threshold (did not fall below the minimum RPD threshold; see explanation below.)

The depth of the oxygenated layer in marine sediment is a measure of ecosystem health. A diverse bottom-dwelling community includes organisms that mix water and oxygen down into the sediment. In an over-enriched environment, organic material deposited on the sediment surface can use up the available oxygen and smother the bottom-dwelling community. Such areas, including some areas of Boston Harbor, have a thin or nonexistent oxygenated layer. The thickness of the oxygenated layer is called the redox potential discontinuity (RPD) depth. In MWRA’s monitoring program, the RPD depth is estimated from sediment-profile images, cross-sections of the upper several centimeters of the sediment taken with a special mud-penetrating prism and camera. The threshold for RPD is half the mean measured in the baseline period (that is, if the thickness of the oxygenated layer fell to less than half the thickness measured pre-discharge, a caution threshold would be exceeded.)
SEDIMENT CONTAMINATION

Sediment contamination levels at the outfall site in 2008 were well below the thresholds.

The sediment contamination thresholds would indicate any unexpected accumulation of toxic contaminants in soft sediments near the outfall. Contaminant levels are compared to sediment guidelines issued by the National Oceanic and Atmospheric Administration (NOAA). These NOAA “ER-M” levels indicate toxic contaminant concentrations above which adverse effects on marine life are often detected. Baseline sediment contamination levels are all well below the ER-M levels for all contaminants, with only low molecular weight polycyclic aromatic hydrocarbons (LMWPAH) reaching to more than half the threshold value.

2008 contaminant levels were within or below the baseline (pre-discharge) range, and also within or below the post-discharge range, except for total DDT (see note below).

<table>
<thead>
<tr>
<th>contaminant</th>
<th>baseline range</th>
<th>warning level threshold</th>
<th>2008 value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAHs (ng/g dry weight)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>acenaphthene</td>
<td>23-41.3</td>
<td>500</td>
<td>27.3</td>
</tr>
<tr>
<td>acenaphthylene</td>
<td>38.3-58.4</td>
<td>640</td>
<td>35.6</td>
</tr>
<tr>
<td>anthracene</td>
<td>114.1-171</td>
<td>1100</td>
<td>127.9</td>
</tr>
<tr>
<td>benz(a)anthracene</td>
<td>221.4-302</td>
<td>1600</td>
<td>236.7</td>
</tr>
<tr>
<td>benzo(a)pyrene</td>
<td>223.6-287</td>
<td>1600</td>
<td>272.0</td>
</tr>
<tr>
<td>chrysene</td>
<td>217.3-288</td>
<td>2800</td>
<td>212.2</td>
</tr>
<tr>
<td>dibenzo(a,h)anthracene</td>
<td>30.5-42</td>
<td>260</td>
<td>35.8</td>
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<tr>
<td>fluoranthene</td>
<td>465-592</td>
<td>5100</td>
<td>470</td>
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<tr>
<td>fluorene</td>
<td>37.9-60.9</td>
<td>540</td>
<td>40.3</td>
</tr>
<tr>
<td>naphthalene</td>
<td>53.5-83.2</td>
<td>2100</td>
<td>56.8</td>
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<tr>
<td>phenanthrene</td>
<td>296.4-405</td>
<td>1500</td>
<td>287.8</td>
</tr>
<tr>
<td>pyrene</td>
<td>440.3-540</td>
<td>2600</td>
<td>380.3</td>
</tr>
<tr>
<td>sum HMWPAH</td>
<td>2986.4-3754</td>
<td>9600</td>
<td>3712.7</td>
</tr>
<tr>
<td>sum LMWPAH</td>
<td>1420.1-2004</td>
<td>3160</td>
<td>1579.5</td>
</tr>
<tr>
<td>total PAH</td>
<td>4482.5-5726</td>
<td>44792</td>
<td>5292.1</td>
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</tbody>
</table>

Other organic contam. (ng/g)

<table>
<thead>
<tr>
<th>contaminant</th>
<th>baseline range</th>
<th>warning level threshold</th>
<th>2008 value</th>
</tr>
</thead>
<tbody>
<tr>
<td>p,p’-DDE</td>
<td>0.28-1.25</td>
<td>27</td>
<td>0.39</td>
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<tr>
<td>total DDT</td>
<td>2.59-5.27</td>
<td>46.1</td>
<td>8.57*</td>
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<tr>
<td>total PCB</td>
<td>10.4-28.6</td>
<td>180</td>
<td>7.5</td>
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</tbody>
</table>

Metals (ug/g dry weight)

<table>
<thead>
<tr>
<th>contaminant</th>
<th>baseline range</th>
<th>warning level threshold</th>
<th>2008 value</th>
</tr>
</thead>
<tbody>
<tr>
<td>cadmium</td>
<td>0.09-0.23</td>
<td>9.6</td>
<td>0.13</td>
</tr>
<tr>
<td>chromium</td>
<td>61.9-86.8</td>
<td>370</td>
<td>71.9</td>
</tr>
<tr>
<td>copper</td>
<td>19.2-27.6</td>
<td>270</td>
<td>14.7</td>
</tr>
<tr>
<td>lead</td>
<td>42.9-47.2</td>
<td>218</td>
<td>40.2</td>
</tr>
<tr>
<td>mercury</td>
<td>0.2-0.29</td>
<td>0.71</td>
<td>0.13</td>
</tr>
<tr>
<td>nickel</td>
<td>15.5-18.5</td>
<td>51.6</td>
<td>14.9</td>
</tr>
<tr>
<td>silver</td>
<td>0.47-0.71</td>
<td>3.7</td>
<td>0.32</td>
</tr>
<tr>
<td>zinc</td>
<td>56.6-69.7</td>
<td>410</td>
<td>57.8</td>
</tr>
</tbody>
</table>

*The reported concentration of one constituent of total DDT, from one sample, is anomalously high in 2008, and is under review, so the 2008 total DDT value may be revised downward. Nevertheless, the DDT is well below the threshold.