

**Massachusetts Water Resources Authority
Second Quarter 2001
Contingency Plan Report on Ambient Monitoring**

Note: This report was revised on November 8, 2001 to incorporate corrected threshold levels for *Phaeocystis* and *Pseudonitzschia*.

MWRA gathers data from the outfall location in Massachusetts Bay on various thresholds outlined in its Deer Island outfall discharge permit. This report shows relevant ambient monitoring results that became available in the previous quarter.

CHLOROPHYLL

Chlorophyll is a measure of the amount of microscopic plants (phytoplankton, or algae) in the water. In Massachusetts Bay, production of algae is the basis of the food web. However, excessive growth of algae can lead to undesirable consequences, such as oxygen depletion at depth due to decomposition of organic matter. Effluent from the outfall is rich in nutrients, and therefore could potentially cause excessive algal growth.

There are annual and seasonal chlorophyll thresholds for the "nearfield", the group of stations within about three miles from the outfall which are most likely to be affected by nutrient-rich effluent. Because the levels of chlorophyll in the water naturally vary over the year, there are separate thresholds for different seasons. In most years, Massachusetts Bay experiences a "spring bloom" characterized by high chlorophyll levels as lengthening days provide enough sunlight for algae to grow quickly. Chlorophyll typically drops in summer as the nutrients in well-lit surface waters are used up. When the weather cools, the surface and bottom waters mix, which usually gives rise to a "fall bloom" as nutrient-rich bottom waters are mixed up into the well-lit surface layers. As the days become short, chlorophyll levels drop again since there is not enough light for algae to grow.

In this report we compare post-discharge chlorophyll data to the thresholds for fall and spring. Fall 2000 actually included one survey before outfall discharge began on September 6, 2000, and five afterward. Spring 2001 included five nearfield surveys.

Measurements of chlorophyll concentration since the activation of the outfall tunnel exceeded the seasonal caution level threshold in the fall, but then dropped below the seasonal threshold in the winter/spring season. Based on the baseline measurements, the caution level threshold for fall is 162 mg/m² (areal average of nearfield). The nearfield mean areal average in fall 2001 was 212 mg/m². For a full description of the fall 2000 threshold exceedance see <http://www.mwra.state.ma.us/harbor/html/20010731amex.htm>. The spring caution level threshold has been set at 173 mg/m². Measurements in the nearfield this past spring (2001) indicate a chlorophyll level of 78 mg/m².

The high chlorophyll in the outfall nearfield reflects a large-scale region-wide pattern independent of the operation of the outfall. The bloom began before the outfall was in operation. Other measures of ecosystem function (dissolved oxygen, organic carbon, benthic respiration, phytoplankton counts) were all normal. Fall chlorophyll levels were above the threshold value in 1999 (before the outfall was operational) as well. The spring chlorophyll levels were low, well below the threshold. MWRA will further evaluate the chlorophyll and other water column monitoring data in upcoming synthesis reports, and through discussions with the Outfall Monitoring Science Advisory Panel.

Monitoring results for fall 2000 and spring 2001 chlorophyll in the outfall nearfield. The actual results are compared with the calculated baseline threshold values. The threshold values are based on baseline survey averages from 17 surveys annually from 1992-2000 at 21 nearfield stations measured at multiple depths.				
	Fall Caution Level Threshold	Actual Fall 2000 Monitoring Results	Spring Caution Level Threshold	Actual Spring 2001 Monitoring Results
Threshold value [Areal chlorophyll (mg/m ²)]	162	212	173	78

NUISANCE ALGAE

Nuisance algae levels in the first monitoring period since the outfall tunnel came on-line were well below thresholds. The current threshold reporting period for nuisance algae is January-April 2001 (five nearfield and three farfield water column surveys). Fall 2000 nuisance algae data were reported in the previous quarter

Nuisance algal blooms are less predictable than the normal, beneficial algal blooms which produce food and oxygen; some blooms did occur during the baseline monitoring period. There is public concern that effluent nutrients could feed a red tide bloom in the vicinity of the new outfall, or otherwise increase the abundance of nuisance algae. Therefore, the Contingency Plan has thresholds for seasonal abundance of *Alexandrium*, *Phaeocystis pouchetii*, and *Pseudonitzschia*, which are triggered if the abundance of any of these becomes unusually high.

ALEXANDRIUM

Alexandrium tamarense typically may bloom during April to June and can cause paralytic shellfish poisoning, known as PSP or red tide; it has been periodically found in Massachusetts since the 1970s. Toxicity is generally not found in shellfish until much higher cell counts are seen in the overlying waters. This spring, *Alexandrium* cells (*Alexandrium tamarense* plus unidentified *Alexandrium* spp.) were observed only in one April sample.

Winter/spring <i>Alexandrium</i> per-sample abundance (cells/l)	
Caution threshold	100
Winter/spring 2001*	18

** maximum of all samples collected between January 1, 2001 and April 30, 2001.

PHAEOCYSTIS

Phaeocystis pouchetii blooms usually occur during February to April but can occur at any time. The species is not toxic, but individual cells can aggregate in gelatinous colonies that are poor food for zooplankton. Winter/spring 2001 abundances were fairly low, and well below the threshold.

Winter/spring <i>Phaeocystis</i> mean abundance (cells/l)	
Caution threshold	2,020,000*
Winter/spring 2001	186,400

*Corrected 11/01

PSEUDONITZSCHIA

Pseudonitzschia multiseriis blooms can occur during November to March and produce domoic acid, which can cause a condition known as amnesic shellfish poisoning. The group of algae including the toxic species *Pseudonitzschia multiseriis*, the closely related *Pseudonitzschia pungens*, and any unidentified *Pseudonitzschia* species was present only at fairly low abundances in winter/spring 2001, well below the threshold.

Winter/spring <i>Pseudonitzschia</i> mean abundance (cells/l)	
Caution threshold	21,000*
Winter/spring 2001	5,700

*Corrected 11/01

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