

Contingency Plan Report

Second Quarter 2005

Ambient Monitoring

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 January-March 2005. No relevant ambient monitoring results became available in April-June 2005, thus, the data in this report are the same as last quarter's report.

MWRA, as part of its monitoring plan, reports on levels of the nuisance algae *Alexandrium* ("red tide") in the nearfield of the Massachusetts Bay outfall. Additional monitoring and reporting on per-sample abundances of *Alexandrium*, which can cause paralytic shellfish poisoning (PSP), is also required by the Contingency Plan. MWRA follows the course of Gulf of Maine *Alexandrium* blooms through Massachusetts Bay. Based on *Alexandrium* cell counts and observations of shellfish PSP toxicity, MWRA initiates surveys for *Alexandrium* in the outfall area, to help determine whether the outfall may affect an *Alexandrium* event.

In response to an unusually robust *Alexandrium* bloom along the coast of Maine that was carried into Massachusetts Bay by the high winds of May 7 and 8, MWRA carried out a series of special surveys targeting *Alexandrium* between May 11 and July 6, 2005. Early data, using rapid molecular probe methodologies from the first survey, show that the single sample abundance of *Alexandrium* in the outfall nearfield exceeded the Caution Level threshold of 100 cells/L, triggering a notification requirement under the Contingency Plan (see <http://www.mwra.state.ma.us/harbor/pdf/20050520amx.pdf>). Preliminary data indicate that the bloom subsided in Massachusetts Bay in early July. Final data from the spring/early summer routine and special *Alexandrium* surveys are not yet available, thus a quantitative report on *Alexandrium* threshold exceedance will be in next quarter's Contingency Plan ambient monitoring report.

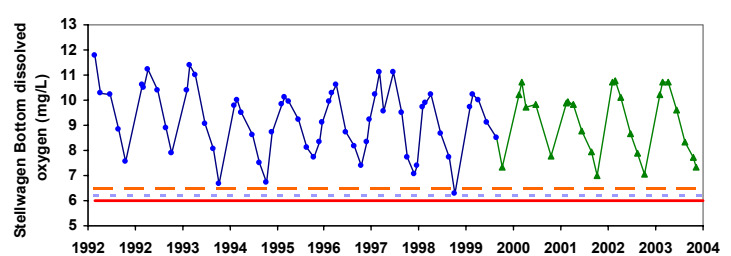
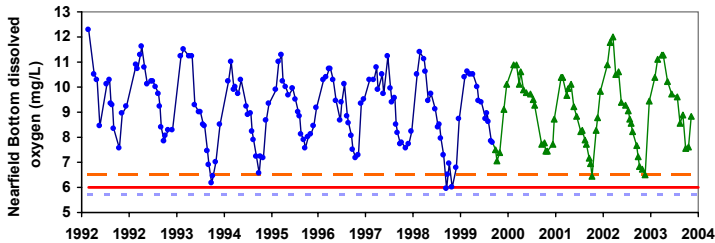
DISSOLVED OXYGEN – September-October 2004

Measurements of dissolved oxygen (DO) concentration and percent saturation in early fall 2004 did not fall below background levels and thus did not exceed thresholds. Likewise, the DO depletion rate did not exceed thresholds.

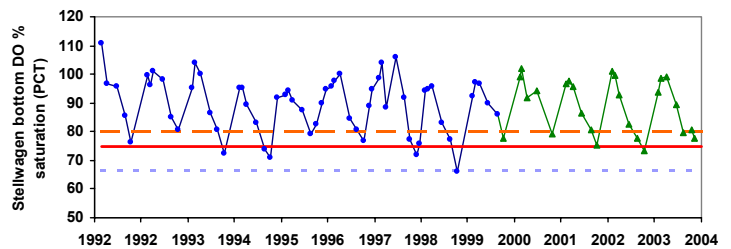
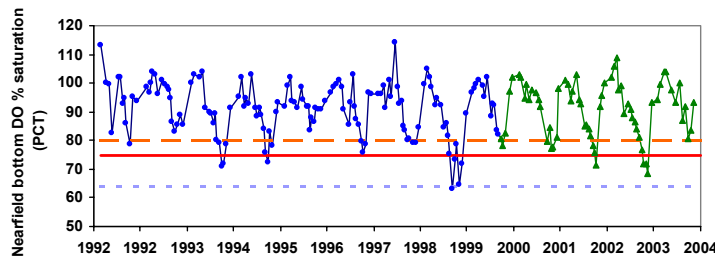
NEARFIELD

STELLWAGEN BASIN

CONCENTRATION



% SATURATION



● pre-discharge
 ▲ discharge
 - - - background level
 - - - caution level
 - - - warning level

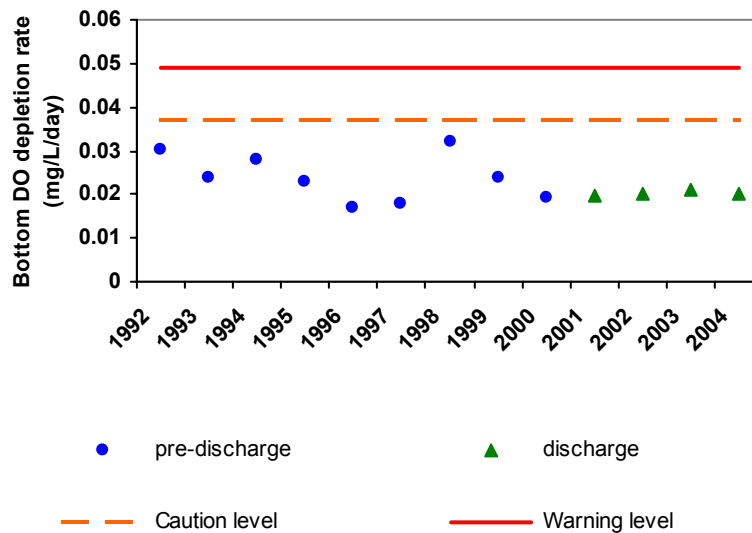
The concentration of dissolved oxygen (DO) in the water indicates the balance between production by algae and consumption by aquatic organisms and the decomposition of organic matter. Excessive organic matter may result in oxygen depletion, which may in turn adversely affect the aquatic ecosystem. The amount of oxygen that the water can hold is related to water temperature, salinity, and pressure; thus, the percent saturation of dissolved oxygen is a measure that takes these factors into account. Monitoring locations for which there are DO thresholds include the "nearfield," the group of stations within about three miles from the outfall, and "Stellwagen Basin," a deep area nine miles east of the outfall. DO thresholds apply to the part of the year when the water column is stratified, *i.e.* from June - October. The current reporting period for dissolved oxygen thresholds is September-October 2004. During this period there were three nearfield surveys and one farfield survey.

Dissolved oxygen concentration and percent saturation naturally fell below 6 mg/l on occasion during the baseline period. The state standard, on which the thresholds were based, allows an exception to numerical thresholds if background conditions are lower, as is the case here; thus, the threshold is not exceeded unless the value falls below the threshold and below background.

Oxygen levels were similar to those seen in several 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 is typically lowest in early autumn.

An additional threshold measure of dissolved oxygen is the rate at which oxygen is depleted during the stratified summer period. 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; 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. The DO depletion rate for the summer of 2004 was low, within the baseline range, and did not exceed the threshold.

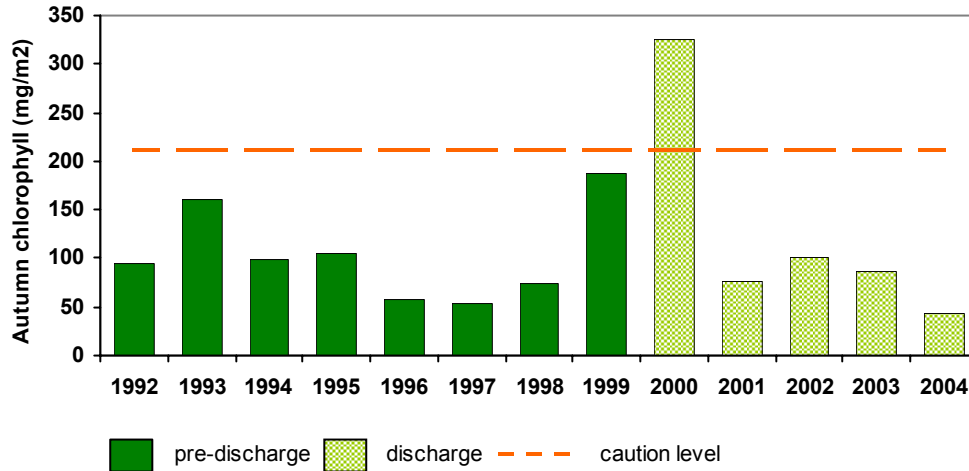
DO Depletion Rate – summer 2004



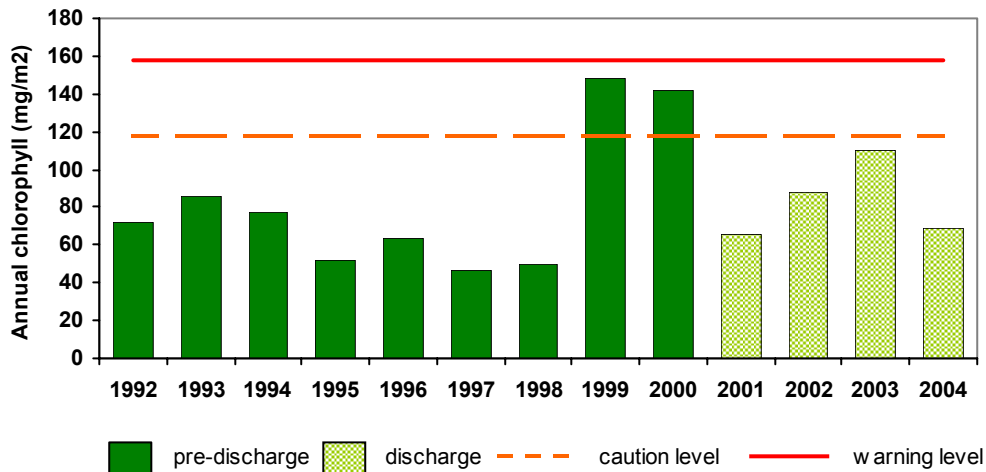
CHLOROPHYLL – September-December 2004

There were no chlorophyll threshold exceedances in this period. The nearfield mean areal average chlorophyll in autumn 2004 was 44 mg/m², well below the caution level threshold¹ for autumn of 212 mg/m², and similar to the levels in the autumns of 1996-97. The 2004 annual average was 69 mg/m², well below the caution and warning thresholds¹ for annual average chlorophyll are 118 and 158 mg/m², respectively.

AUTUMN



ANNUAL



¹ Threshold recalculated for new survey schedule: in 2004, MWRA implemented a new outfall sampling design, which included dropping two surveys in the late autumn (when chlorophyll is generally low.) The baseline means and the thresholds (the 95th percentile of the baseline mean) were recalculated mathematically deleting baseline data corresponding to the dropped surveys. The recalculated autumn threshold for chlorophyll is higher than the old threshold of 161 mg/m². The recalculated annual thresholds for chlorophyll are slightly higher than the old caution and warning levels for annual average chlorophyll of 107 and 143 mg/m², respectively. On the graph, the results for all years are calculated using the new survey schedule, and thus the 2000-2003 autumn values and the 2001-2003 annual values differ from the then-effective threshold results, which were reported in earlier quarterly reports.

In this report, we compare post-discharge chlorophyll data to the thresholds for autumn 2004 (September-December), which included four surveys, and for 2004 as a whole. The graph includes data since the start of the monitoring program in 1992.

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 that 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 the post-discharge chlorophyll data (areal average of nearfield) to the thresholds for autumn 2004 (September through December), which included six nearfield survey. The graphs include data since the start of the monitoring program in 1992.

The caution level threshold for autumn is 212 mg/m². The nearfield mean areal average in autumn 2004 was 44 mg/m², well below the threshold and in fact lower than any other monitoring year. The caution and warning levels for annual average chlorophyll are 118 and 158 mg/m², respectively. The 2004 annual average was 69 mg/m², well below the thresholds. Because of the absence of a fall bloom and the relatively small winter/spring bloom, the annual average is lower than most recent years.

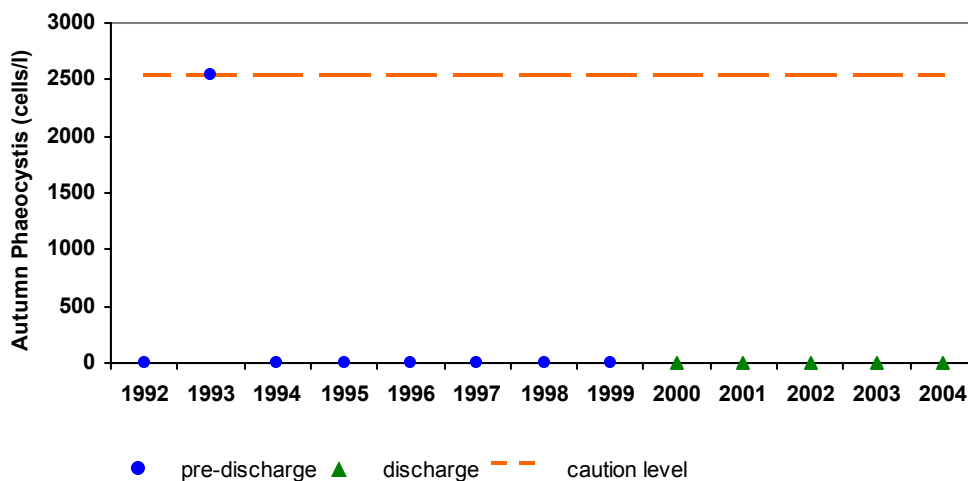
NUISANCE ALGAE – September-December 2004

Phaeocystis pouchetii was not observed, and *Pseudonitzschia* was present only at low abundances in the nearfield in autumn 2004, well below the threshold.

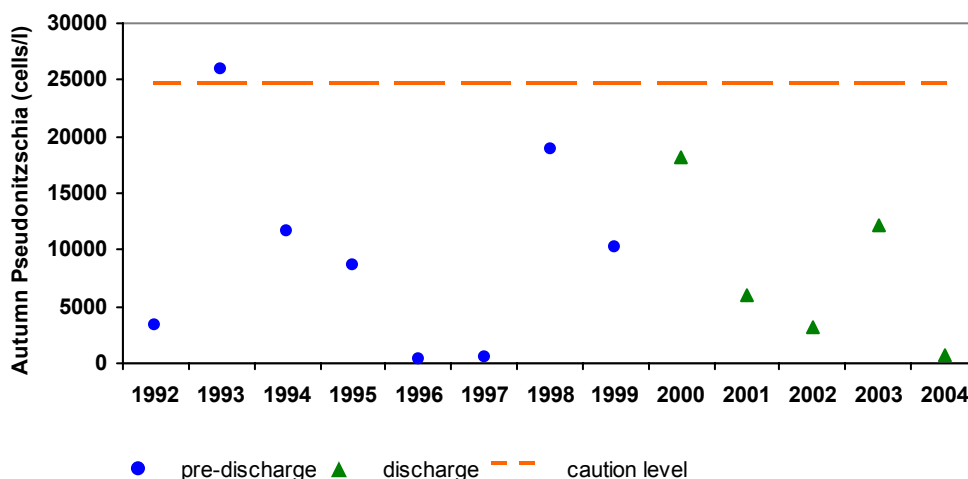
No samples contained *Alexandrium tamarense* and thus none exceeded the threshold of 100 cells/liter during the present reporting period (September-December 2004.)

In this report, we compare post-discharge *Phaeocystis* and *Pseudonitzschia* data to the thresholds² for autumn 2004 (September through December), which included four surveys. We also compare the per-sample results for *Alexandrium* in the autumn surveys to the threshold.

PHAEOCYSTIS Autumn

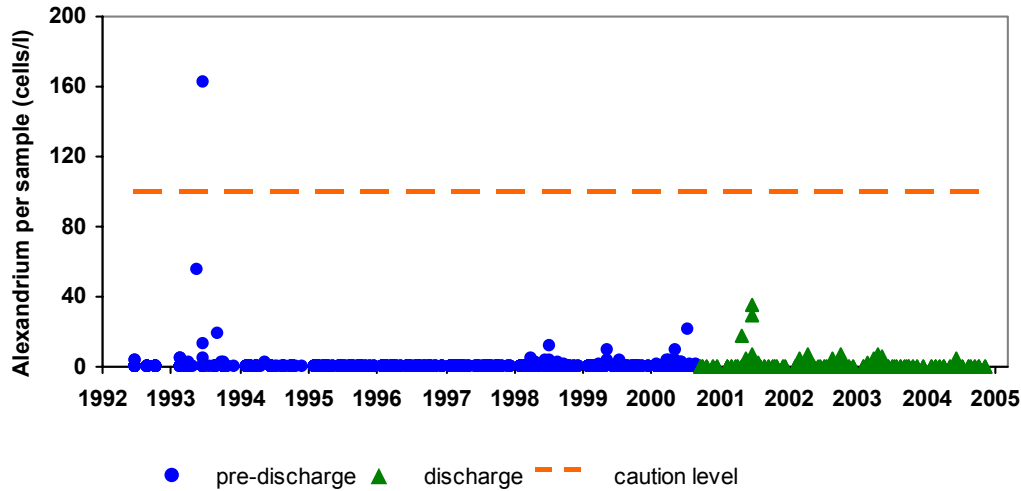


PSEUDONITZSCHIA Autumn



² Threshold recalculated for new survey schedule: in 2004, MWRA implemented a new outfall sampling design, which included dropping two surveys in the autumn. The baseline means and the thresholds (the 95th percentile of the baseline mean) were recalculated mathematically deleting baseline data corresponding to the dropped surveys. The recalculated autumn *Phaeocystis* threshold is slightly higher than the old threshold of 2,370 cells/l. The recalculated autumn threshold for *Pseudonitzschia* is very slightly higher than the old threshold of 24,600 cells/l. On the graph, the results for all years are calculated using the new survey schedule, and thus the values for 2001-2003 may differ from the then-effective threshold results, which were reported in earlier quarterly reports.

ALEXANDRIUM



Nuisance algal blooms are less predictable than the normal, beneficial algal blooms that produce oxygen and food for marine life; some nuisance 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 abundance of *Alexandrium*, *Phaeocystis pouchetii*, and *Pseudonitzschia*, which are triggered if the abundance of any of these becomes unusually high.

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 may be poor food for zooplankton. As in most previous monitoring years, *Phaeocystis* was not observed in any nearfield samples in autumn 2004.

Autumn <i>Phaeocystis</i> mean abundance (cells/liter)	
Caution threshold	2,540
Autumn 2004	0

PSEUDONITZSCHIA

Pseudonitzschia multiseries 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 multiseries*, the closely related *Pseudonitzschia pungens*, and any unidentified *Pseudonitzschia* species was present only at low abundances in the nearfield in autumn 2004, well below the threshold.

Autumn <i>Pseudonitzschia</i> mean abundance (cells/liter)	
Caution threshold	24,700
Autumn 2004	660

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. As in most previous autumns, in the autumn of 2004 *Alexandrium* cells (*Alexandrium tamarense* plus unidentified *Alexandrium* spp.) were not observed in any samples.

September-December <i>Alexandrium</i> per-sample abundance (cells/liter)	
Caution threshold	100
September-December 2004*	0

*** maximum of all samples collected between September 1, 2004 and December 31, 2004.**

FISH AND SHELLFISH TISSUE CONTAMINATION

Mercury contamination in winter flounder remained low and similar to other years, and did not exceed the threshold.

The fish tissue contamination thresholds are designed to identify unexpected effects on marine life. Data available this quarter include mercury contamination in winter flounder, which were sampled at the outfall site in April 2004. In 2004, MWRA implemented a new outfall monitoring study design that reduces the frequency of fish/shellfish contaminant sampling. However, in order to track the mercury trend in flounder, MWRA did measure mercury in flounder in 2004. Caution and warning thresholds are set at 50% and 80% of the FDA Action Limit for mercury in flounder.

MERCURY

