

# Contingency Plan Report Fourth Quarter 2008

## 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.

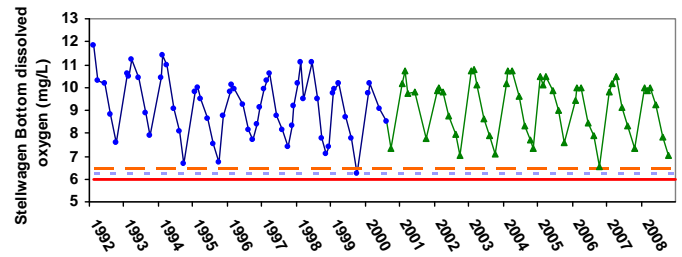
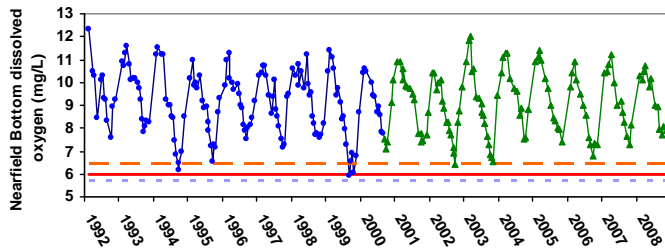
### DISSOLVED OXYGEN (DO) – late September-October 2008

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.

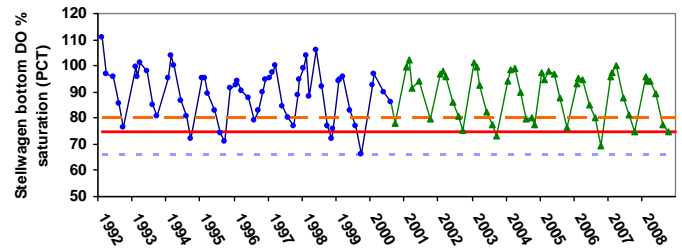
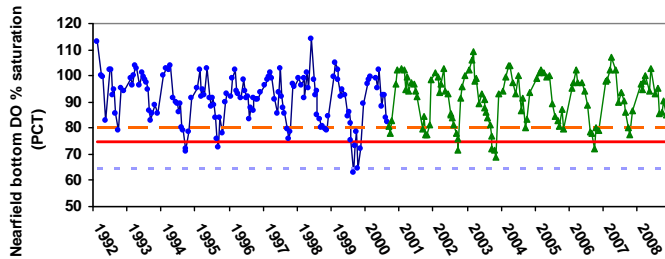
**NEARFIELD DO**

**STELLWAGEN BASIN DO**

**CONCENTRATION**



**% SATURATION**

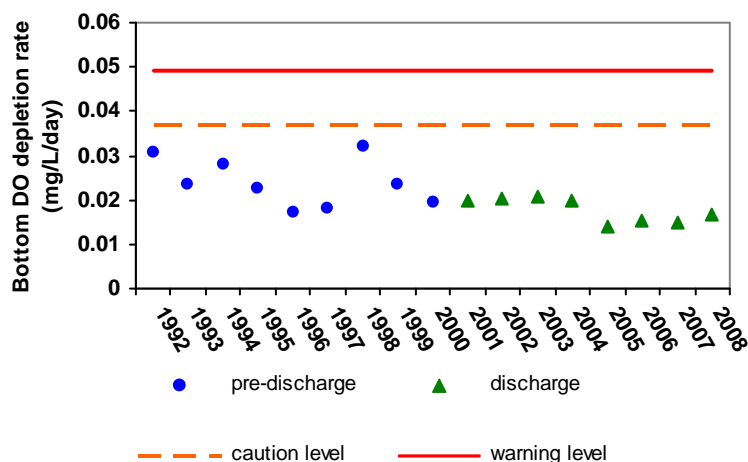


● pre-discharge     
 ▲ discharge     
 --- background level     
 --- caution level     
 --- warning level

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.



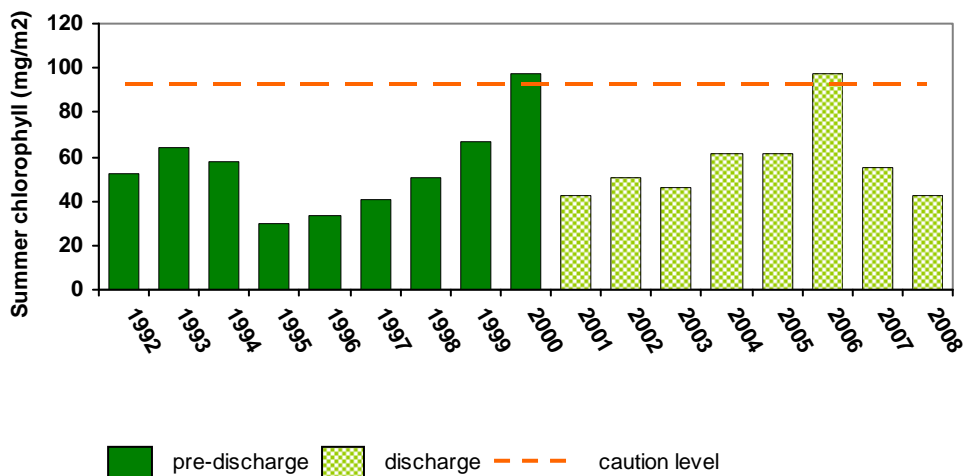
Even if dissolved oxygen concentrations remain healthy, an excessively rapid rate of decrease could signal a future problem. A low rate indicates DO dropped only slowly. The threshold for DO depletion rate is based on a change from the baseline rate; the caution threshold is a rate faster than 1.5 times 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/m<sup>2</sup>, below the caution level threshold for summer of 93 mg/m<sup>2</sup>.

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



## NUISANCE ALGAE – SUMMER 2008

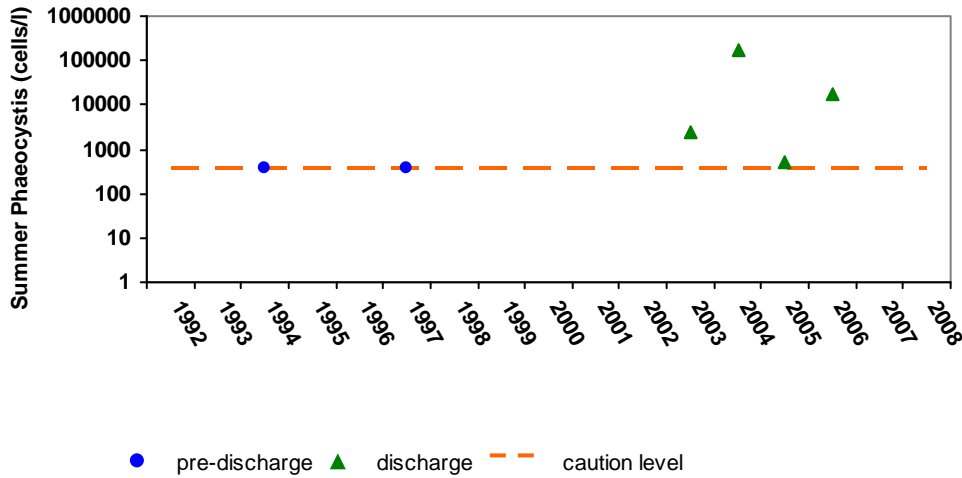
In the figures below, we compare *Phaeocystis* and *Pseudonitzschia* data to the [nuisance algae thresholds](#) for summer 2008 (May through August), which included four surveys. We also compare *Alexandrium* data to the threshold for each sample in July through August 2008.

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.

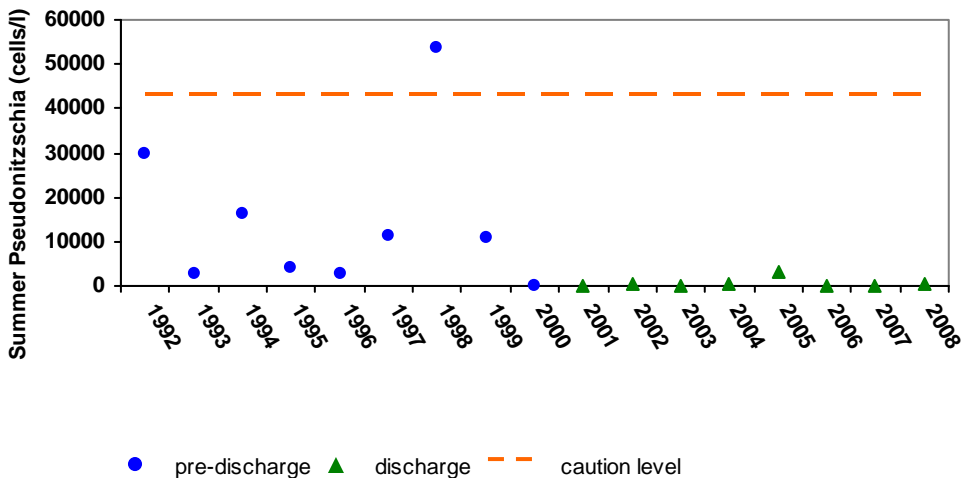
#### PHAEOCYSTIS, Summer



Summer <i>Phaeocystis</i> mean abundance (cells/liter)	
Caution threshold	357
Summer 2008	0

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

#### PSEUDONITZSCHIA, Summer



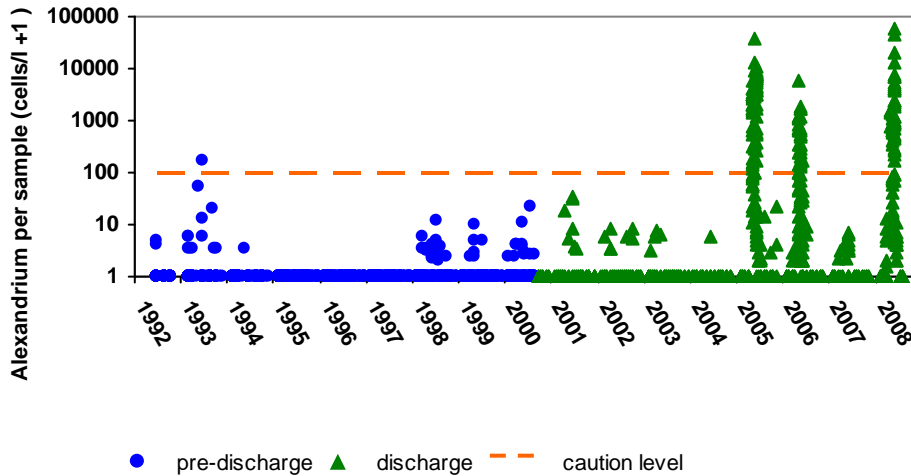
Summer <i>Pseudonitzschia</i> mean abundance (cells/liter)	
Caution threshold	43,100
Summer 2008	540

## 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>). 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.)

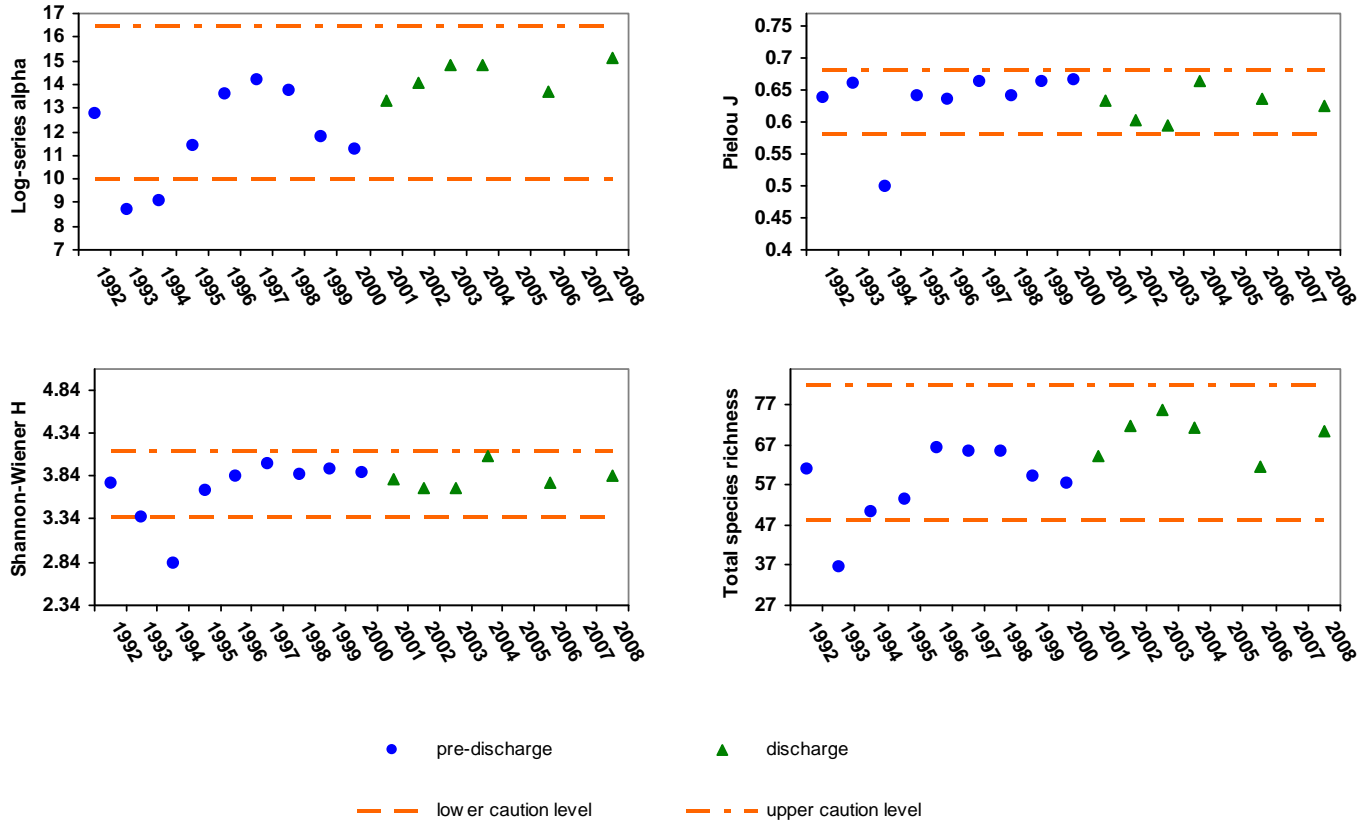


July-August <i>Alexandrium</i> per-sample abundance (cells/liter)	
Caution threshold	100
Summer 2008	0*
* maximum of all samples collected between July 1, 2008 and August 31, 2008	

## SEDIMENT BIODIVERSITY - 2008

### DIVERSITY

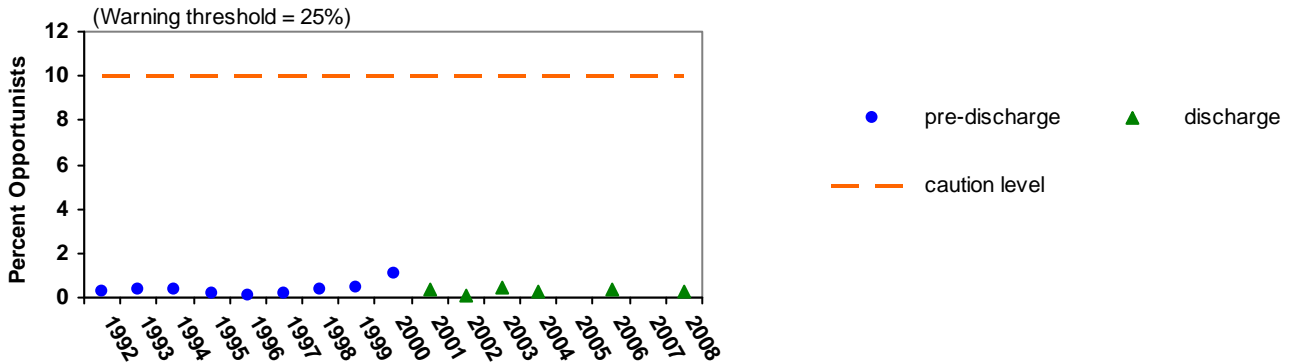
The annual survey of sediment-dwelling communities in 2008 showed that the benthic diversity was normal at the outfall site, and did not exceed any of the [benthic diversity thresholds](#).



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

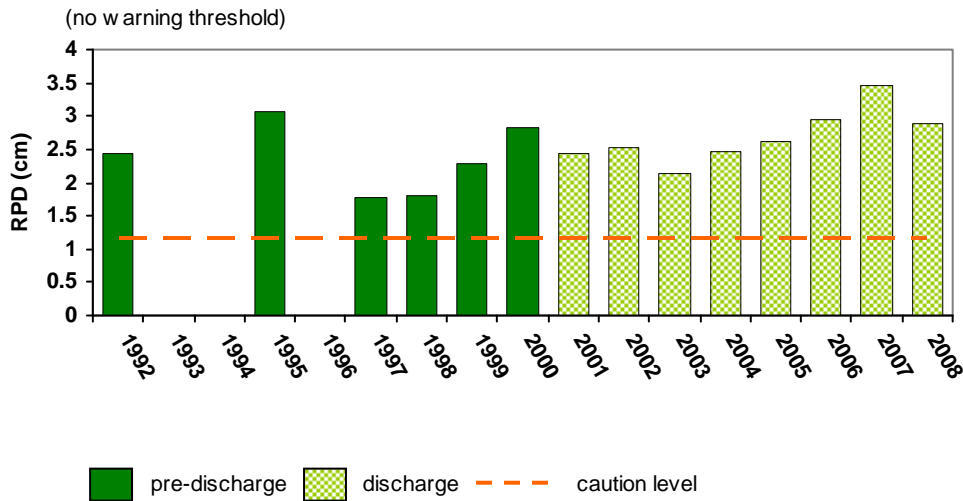
The annual sampling in 2008 showed that the numbers of [opportunistic benthic organisms](#) remain normal at the outfall site and did not exceed the caution threshold of 10% of the total population.



No data are shown for 2005 and 2007 because a different set of stations was sampled in those years.

## SEDIMENT ENRICHMENT - 2008

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).

	contaminant	baseline range	warning level threshold	2008 value
<b>PAHs (ng/g dry weight)</b>				
	acenaphthene	23-41.3	500	27.3
	acenaphthylene	38.3-58.4	640	35.6
	anthracene	114.1-171	1100	127.9
	benz(a)anthracene	221.4-302	1600	236.7
	benzo(a)pyrene	223.6-287	1600	272.0
	chrysene	217.3-288	2800	212.2
	dibenzo(a,h)anthracene	30.5-42	260	35.8
	fluoranthene	465-592	5100	470.
	fluorene	37.9-60.9	540	40.3
	naphthalene	53.5-83.2	2100	56.8
	phenanthrene	296.4-405	1500	287.8
	pyrene	440.3-540	2600	380.3
	sum HMWPAH	2986.4-3754	9600	3712.7
	sum LMWPAH	1420.1-2004	3160	1579.5
	total PAH	4482.5-5726	44792	5292.1
<b>Other organic contam. (ng/g)</b>				
	p,p'-DDE	0.28-1.25	27	0.39
	total DDT	2.59-5.27	46.1	8.57*
	total PCB	10.4-28.6	180	7.5
<b>Metals (ug/g dry weight)</b>				
	cadmium	0.09-0.23	9.6	0.13
	chromium	61.9-86.8	370	71.9
	copper	19.2-27.6	270	14.7
	lead	42.9-47.2	218	40.2
	mercury	0.2-0.29	0.71	0.13
	nickel	15.5-18.5	51.6	14.9
	silver	0.47-0.71	3.7	0.32
	zinc	56.6-69.7	410	57.8

\*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.