will the discharge be very contaminated?

The secondary effluent discharge will meet stringent state and federal standards to ensure that it will not pose a threat to either human health or the health of the environment.

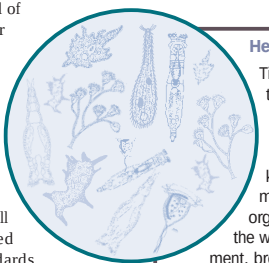
Treatment is a critical step in minimizing adverse effects of sewage discharges. The centerpiece of the Boston Harbor Project is the state-of-the-art primary and secondary treatment plant nearing completion on Deer Island. This massive, multibillion dollar project was built to comply with strict environmental regulations in order to protect human health, the health of the Harbor, and the ecology of the Bays system.

The secondary-treated wastewater to be discharged into Massachusetts Bay is very different from the inadequately treated primary effluent and sludge that were discharged into Boston Harbor for decades. As shown in Table 1, while primary treatment removes 50 to 60 percent of the total suspended solids in wastewater, secondary treatment increases the removal of solids to 85 percent or more.

Table 2 shows the levels of toxic pollutants in primary and secondary treated effluent, and the predicted concentrations in the area around the new outfall after dilution compared to water quality standards.

After secondary treatment (Figure 13), the concentration of toxic pollutants in the effluent is very low–measured in parts per billion or parts per trillion. Levels of many of these pollutants in the secondary effluent are already low enough to meet regulatory standards for receiving water. In fact, after dilution at the new outfall, most contaminants are 10 to 1000 times lower than water quality standards allow.

Nutrients are the only components of sewage entering the treatment plant that are not significantly reduced by secondary treatment. Therefore, MWRA carefully monitors the potential effect of nutrient issues on the Bays system, and nutrients have received particularly intensive scrutiny by regulatory agencies.



Helpful Microbes

Tiny microbes including bacteria, ciliates, and rotifers, as seen here through a microscope at about 500-fold magnification, are the key to secondary treatment. These helpful microorganisms feed vigorously on the wastewater during treatment, breaking down and removing contaminants.

Tables 1 and 2. Secondary treatment at the Deer Island treatment plant, combined with dilution at the new outfall, will ensure that levels of toxic contaminants in the receiving waters are well within water quality standards. The table shows selected toxic constituents of wastewater that are regulated by EPA. For most constituents, the final concentration in the receiving water will be far lower than EPA criteria (for details see end note, p.26).

Table 1. Comparison of primary and secondary removal of pollutants

Pollutant	Primary removal	Secondary removal
Total suspended solids (TSS)	50-60%	85+%
Biochemical oxygen demand (BOD)	25-40%	85+%
Toxic contaminants	0-50%	50-90%
Nutrients	5%	10-15%
Pathogens	0-50%*	80-99+%*

*These numbers indicate removal before disinfection. Disinfection further reduces pathogens to safe levels.

Table 2. Toxic contaminants reduced by treatment and dilution

	Parts per billion (micrograms/liter)			Parts per trillion (nanograms/liter)		
	Copper	Mercury	Lead	DDTs	TOTAL PAH	TOTAL PCBs[7]
Primary effluent[1]	103	0.3	29.2	31	54,932	57
Secondary effluent[1,2]	21.6	0.1	3.3	3	3,250	12
Concentration after dilution[3]	0.27	0.0013	0.04	0.008	8.93	0.033
Receiving water quality standards[4,5,6]	2.9	0.025	8.5	2.02	42,000	0.045

Secondary wastewater treatment schematic

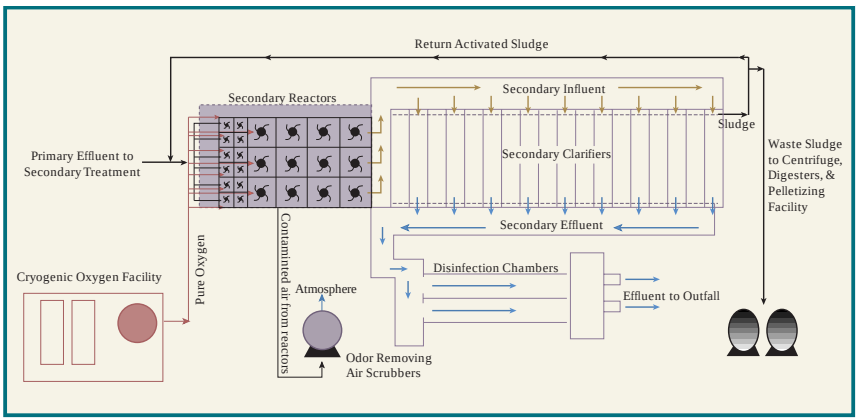
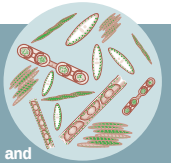


Figure 13. Secondary wastewater treatment follows primary treatment at Deer Island. Primary treatment removes solids by simple physical processes: in settling tanks (clarifiers), heavy solids (sludge) sink to the bottom and lighter solids (scum) float to the surface. These solids are removed; the remaining liquid is primary effluent, which is then undergoes secondary treatment. Within the secondary reactors, the primary effluent is mixed with pure oxygen. The oxygen and mixing stimulate the rapid growth of beneficial microbes (bacteria, protozoans, and other tiny organisms) in the wastewater, which consume more solids and break down contaminants. After about two hours, more sludge and scum are separated out in the secondary clarifiers. A portion of the secondary sludge, rich in beneficial microbes (activated), is returned to the reactors, where it is used to treat more primary effluent. Waste sludge and scum are sent to Deer Island's egg-shaped digesters, to be further broken down by microbes and eventually converted to fertilizer pellets. The clarified secondary effluent is disinfected and discharged to the ocean through Deer Island's outfalls (Figure after D. Duest, MWRA)

nutrients



Nutrients, especially nitrogen and phosphorous, are familiar as the active ingredients in lawn and agricultural fertilizers. Nutrients are also essential for the growth of plants (seagrasses, seaweed, and microscopic floating algae called phytoplankton) in the ocean. In the marine environment, excessive amounts of nutrients, especially nitrogen, stimulate the growth of phytoplankton and seaweeds and can cause nuisance algal blooms like brown or red tides (eutrophication). The eventual decaying of these plants can deplete dissolved oxygen levels in the water and sediment.

Nutrients from the present outfalls exit the Harbor to the Bay in effluent plumes at the surface of the water, where sunlight and nutrients induce abundant phytoplankton growth. One major benefit of the new outfall is that diluted effluent will be discharged at the bottom of Massachusetts Bay, 110 feet below the water's surface. During the summer when there is the most light, the discharge will be trapped by stratification about 50 feet below the surface. Most phytoplankton growth is at the surface, where there is a lot of light. Nutrients from the discharge at the sea floor will generally not reach the surface during the summer, when there is the most potential for excess growth. Therefore, the outfall is not likely to contribute to eutrophication in the Bay.