

Ventilating MWRA's 9.5-Mile Effluent Outfall Tunnel

On September 6, 2000, the Massachusetts Water Resources Authority (MWRA) celebrated the end of effluent discharges to Boston Harbor, effectively marking the completion of the 11-year, \$3.5 billion Boston Harbor Project.

On July 12, 1999, the tragic deaths of two divers in the outfall tunnel brought the tunnel portion of the project to a halt. The divers, who were experienced and certified, were victims of the failure of their bottled air during the removal of safety plugs. The safety plugs were located at the base of each riser at its tunnel adit. The accident caused OSHA to demand that the final steps to bring the tunnel on line could be done only by ventilating the entire tunnel. At the time, the airline used during boring had already been removed from the tunnel and a reinstallation would have been costly and prevented the tunnel from being completed before late fall when bad weather sets in. Kenneth Chin of MWRA's Program Management Division came up with an idea for a unique Offshore Ventilation Option in late 1999. His idea was to:

1. Use a jack-up barge similar to the one used to install the risers and diffusers;
2. Place the barge over one of the three risers from which the safety plugs had already been removed, 110 feet below the water's surface,
3. Install and dewater a caisson that would be attached to the barge and left open to the atmosphere over that diffuser;
4. Open the diffuser manhole cover to the atmosphere in the caisson
5. Pump fresh air into the tunnel through the tunnel shaft on Deer Island
6. Pull the air from the ocean end of the tunnel, out through the caisson, to the atmosphere.

The challenge was to look past the original purpose of the risers (to discharge effluent) and see other possibilities. The success of this effort required the Boston Harbor Project design engineer, his marine consultant (Eldon Abbott, Parsons Brinkerhoff), the contractor (Dave Beck, Cashman), and his consultants to work together over several months to flesh out, design, obtain approval for, and implement this Offshore Ventilation Plan. The result was the completion of plug removal from the remaining 52 risers. The work was done within five days in a well-ventilated, safe tunnel environment. The Plan saved the months of effort that conventional bag line ventilation system installation would have required.

The Ventilation Plan and the experience in blowing air into the tunnel may also provide a viable way for performing maintenance inside the tunnel. Using the Ventilation Plan, the tunnel could be dewatered and workers could be brought into the tunnel to perform the necessary work.

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1. The IB909 jack-up barge returned to Massachusetts Bay to install a caisson and a ventilation pipe in order to bring air into the effluent outfall tunnel.



2. The caisson was 140-foot-long and 48-inches in diameter. The end of the caisson featured a bell-shaped construction that rested over a diffuser cap on the seafloor. An inflated rubber seal around the bottom prevented leakage. When the caisson was in place, all the water was pumped out of it.



3. When the caisson was dry, a smaller pipe was inserted into the caisson and a diver was lifted by mancatcher into the pipe. When he reached the top of the diffuser, he opened the manhole cover that separated the diffuser from the outfall tunnel below. A crane lifted the cover away from the manhole.



4. Once an opening was made into the tunnel, air was blown in from the Deer Island shaft and exhausted out through the newly-installed pipe at the diffuser.



5. When the air was deemed sufficient for workers, a crew of divers went into the tunnel and within five days removed the remaining safety plugs that separated the tunnel from its 55-riser-pipe diffuser system.



6. The plugs were removed from the tunnel and remained near the tunnel shaft until removed from Deer Island.