



 **Massachusetts Water  
Resource Authority**

Overview

**Country or Region:** Boston, MA

**Industry:** Water Management

**Business Situation**

To control and manage water and sewer operations in the Boston Harbor and Massachusetts Bay by providing reliable, cost-effective, high-quality water and sewer services for the protection of the environment and public health.

**Solution**

The PI System was chosen to be the core data solution for MWRA's Boston Harbor Project because of its high data integrity, rich client tools, real-time notification and the flexibility to create interactive displays based on real-time data.

**Benefits**

- MWRA is admired for its state-of-the-art operations
- Chemical management savings due to universal, consistent access to operations information and tightened control based on plant performance overviews of chemical processes
- Improved public confidence based on faster, more accurate documentation for federal/state agencies; reduced manpower for data management
- Healthier sea life, improved water quality, cleaner environment

**OSIsoft helps MWRA improve real-time plant performance, aid Boston Harbor cleanup**



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David Duest, Manager of the Process Control Group, Deer Island, MWRA

A wastewater treatment organization in Massachusetts has been implementing OSIsoft's PI System (PI) as the core of an enterprise-wide solution. With the help of the real-time data collected and distributed by PI, the Massachusetts Water Resource Authority (MWRA) is able to achieve real-time notification of events to the employees who need to know; real-time pricing of power in order to determine the most cost-effective approach to on-site power usage; deliver accurate and timely compliance reporting to local and federal agencies; and, perhaps best of all, play a key role in improving the quality of the environment in Boston Harbor and Massachusetts Bay.

In the early 1980s, Boston Harbor was one of the dirtiest in the nation. To solve the problem, the Massachusetts legislature in 1984 created the Massachusetts Water Resource Authority, an independent organization that took over control of water and sewer operations in the Boston area from the Metropolitan District Commission.

Among their responsibilities was construction of a new secondary wastewater treatment facility on Deer Island to replace the failing and undersized primary treatment plants at Deer Island and Nut Island in Boston Harbor. MWRA was chartered with providing reliable, cost-effective, high-quality water and sewer services to protect public health, as well as to promote responsible environmental stewardship.

## Massachusetts Water Resource Authority (MWRA)

Critical to the success of the new treatment plant was the ability to collect and analyze real-time information throughout the entire treatment process, from pumping stations to primary and secondary treatment, disinfection, dechlorination, and discharge to a new outfall tunnel that extends 9.5 miles into Massachusetts Bay. As part of the Boston Harbor Project, MWRA was required to provide ongoing reports on plant operations and water quality to several agencies at the local, state and federal levels, to ensure that neither the Clean Water Act of 1972 nor the public trust would be violated again. The Project set ambitious deadlines for different phases of the construction, and aimed to transform Boston Harbor into a showcase of civic environmental success.

Since the mid 1990s, OSIsoft's PI System has been deployed at the new Deer Island treatment plant to collect real-time data on plant operations and integrate with a variety of information sources throughout the plant (both on-island and off-island), along with an ABB (formerly Bailey) Infi 90 DCS, Oracle database, and water works supervisory control and data acquisition (SCADA) system.

Under the direction of David Duest, Deer Island's Manager of the Process Control Group, the Platform facilitates better decision-making and reporting for operators, engineers and supervisors, while optimizing the costs for chemicals, maintenance and power generation.

"Our goal was to integrate all of the available data for the plant operations group into a user friendly, consistent interface to better predict future events, and adapt to all systems in order to make them as efficient as possible," summarizes Duest, who went , to work for MWRA in 1990.

In 2002 he became manager of the process control group, overseeing a staff of 20 engineers, operators and computer specialists.



*ProcessBook, the Platform's user-friendly interface, provides views of the real-time process operations to everyone's desktop.*

## An integrated real-time overview of plant operations

Located just northeast of downtown Boston, the Deer Island plant sits on 200 acres of land and serves more than 2.3 million people, representing over 43 communities and 35 percent of the total population in the state of Massachusetts. As the second largest treatment plant in the U.S. (second only to Detroit), it has a capacity of up to 1,270 million gallons per day (mgd) with an average of 360 mgd treated. Whereas the previous plant on Deer Island only included primary treatment, a process that Duest estimates typically removes 40-60 percent of the solids, the new secondary treatment plant removes greater than 90 percent.

When Duest first began working for MWRA in 1990 it took him several days of painstaking work to create the regular detailed reports required by the EPA and other federal, state and local agencies. He quickly realized that automation would be key to the success of the new plant, and that integrating all available data was essential.

One of his first steps was to help shape the focus of operations to make sure all the tags and equipment were configured properly, from the DCS to the PI System. He taught himself OSIsoft's PI System and created various displays in ProcessBook, the PI System rich client that facilitates inter-active displays based on real-time data.

“When I come into the office every morning, I first look at the displays to find out what’s going on, and I’m not the only one,” says Duest. “Everyone at Deer Island has access to PI, whether they’re here on site or working from home through a VPN connection (virtual private network). The PI System is used for compliance reporting, providing a real-time process overview of operations, data for evaluating the treatment performance, optimization of various treatment processes, and evaluations of incidents, as well as for tracking power generation pricing.”

One of the Platform’s key roles is to serve as an alert system when the process is not operating properly. It sends an alert to cell phones, pagers, and/or emails, when critical situations arise, for example when the plant loses disinfection. Other possible situations include a loss of chlorine residual; if the ratio of sodium hypochlorite feed to flow changes dramatically; if a rapid change in level in a storage tank occurs, and so on. The system is used extensively from a chemical management perspective.

The integrated data flow is significantly more effective than the manual approach used in the plant’s early days. Prior to leveraging the PI System embedded in the Bailey DCS (distributed control system), the process group had relied on paper operator logs, which were subject to human error. “If something happens in the plant that needs quick attention,” explains Duest, “the operator is obviously going to focus his attention immediately on the problem, rather than trying to document all the various activities and the extenuating factors. PI delivers better accuracy and consistency about what is going on in the plant and how we might have to react to any problems in advance.”

MWRA’s current Windows-based PI3 System collects, analyzes and archives information on more than 10,000 tags in the plant. It works along with other systems on the plant site to provide data to the Process Control Group. A Beckman CALS LIMS system (laboratory information management system) documents more than 400,000 analyses annually and is used to track sampling at every major step in the treatment process, quality control tracking, laboratory instrument certification and data validation. The raw data collected by PI on plant operations, such as alarm management, is fed into an Oracle data warehouse through a connection (created by Duest and the MWRA MIS department). The reports are produced from that.

PI also serves as a long-term archive for the plant operations group. According to Duest, he can go back to a 50-year storm event like that of March 2001 to see the effects it had across the plant. The PI System therefore serves not only to reveal short-term occurrences but long-term as well.

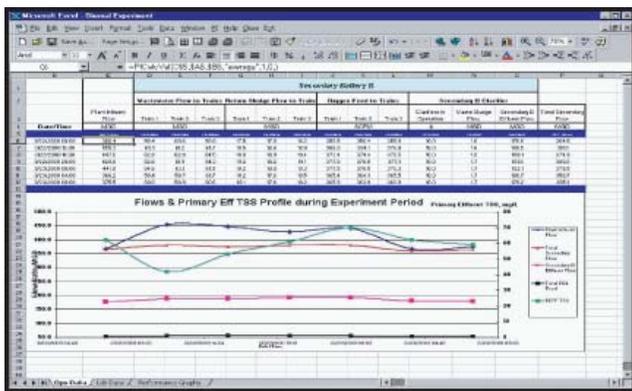
## **Saving money on the power grid**

Deer Island has creatively extended the value of the PI System beyond just the process operations of the plant. One of the critical and inescapable facts about water treatment is its reliance on power to conduct operations. In addition to the main electrical supply line going into the plant, Deer Island has two combustion turbine generators, two diesel generators, a steam turbine generator, and two hydro-electric turbines onsite to minimize purchase power, increase operational flexibility and to provide backup power when necessary. This is to prevent downtime or critical accidents, should the electrical supply line fail.

An organization known as ISO New England is responsible for the day-to-day operation of New England’s bulk electric generation and transmission, and records the megawatt pricing on a regular basis. The MIS group at MWRA created a program to monitor the ISO New England website, extract data regarding the market clearance price every few minutes, and integrate it into the PI System. This enables the process operations group to decide whether to operate their combustion turbine generators onsite using fuel oil or to purchase power off the grid.

In addition, ISO New England has a program for the major power generators, including Deer Island, that pays the power generators if they take themselves off the grid during peak demand. To receive the payment requires verification, however. Normally a user would pay to have an energy meter installed to deliver that verification to ISO New England. Deer Island, however, came up with an innovative and cost-effective solution and wrote a program in VisualBasic code that sends an automatic email to ISO to notify them that they have taken themselves off the grid. By extracting data from the ISO New England website to monitor prices, and by sending ISO New England their data on generation, Deer Island is able to take advantage of lower prices with no additional capital expenditure.

On average, Duest estimates that the plant saves from \$5,000 - \$60,000 a day when they are able to use their own resources this way. These savings are an ROI boon to the plant, especially in light of the loss in 2002 of \$50 million in annual state funding that previously had served to offset MWRA rate increases. "A Massachusetts state budget crunch forced money to be redirected to other areas, including homeland security," says Duest. "As a result, we had to look inward for additional ways to reduce costs."



*DataLink, the Platform's Excel-based reporting tool, gives everyone in the operation real-time data that is critical to process optimization.*

## The PI System reporting helps MWRA meet federal, state and local requirements

From the beginning, the MWRA has been under pressure to provide clear, frequent reports to monitor the health of the harbor and the integrity of the Deer Island operations. "There are a lot of permit requirements to prove that we are meeting effluent regulations," says Duest. "Some are monthly, some are quarterly, some are annual. You have to have an easy, flexible way to get to the data. And our number one mission is to serve the public.

"Our 10-page reports used to take one person several full days to complete. Now we have a 120-page monthly operational summary that can be completed in the same amount of time, using the PI System. These reports are now accessible in multiple formats. Anyone at the plant can obtain the information via email, the Intranet, or for a few supervisors, in hard copy. Many of the reports are exported via DataLink, which delivers data into a Microsoft Excel file and creates easy-to-read reports."

The monthly report submitted to the EPA by the treatment plant covers wastewater treatment data, discharge monitoring reports, air emission reports, power generation reports, and overall plant performance reports.

In the future, Deer Island will leverage the Pi System for additional functions and analyses, such as temperature monitoring, vibration monitoring, and more digital states. It will also be used more heavily for predictive maintenance, further reducing downtime and unforeseen problems. Over the past few years, Deer Island has won both local and national awards for its facility asset management program, which focuses on leveraging their monitoring to improve predictive maintenance, reduce downtime, and preserve capital.

## Benefits/Results

In the eight years since its implementation, the Platform has played an important role at the Deer Island plant, delivering numerous benefits to the process control group and the Authority as a whole. These include:

**Universal, consistent access** — everyone who works at Deer Island, regardless of location, has access to plant operations information through the MWRA's wide area network, VPN connections or dialup.

*Chemical management savings* — a quick glance can tell operators how the chemical processes are performing at various areas of the plant, such as the disinfection and dechlorination processes. The Platform has helped tightened control.

**Better documentation for federal/state agencies** — the EPA and other agencies value Deer Island's accurate reporting, which has improved public confidence in the Harbor Project.

*Reduced manpower on data management* — previously it required four people to manage the volume of data; now it only requires 1.5.

**Integrated data** — rather than operating in isolation, multiple databases of information work with the PI System to provide up-to-the-minute information on all aspects of the plant's performance.

*Faster reports* — the time to complete required local, state and federal reports is now a fraction of the time previously required; for example, some reports that formerly took three days to prepare now take three seconds.

Since the inception of the project, the Boston Harbor's sea life has grown healthier and the water quality improved. Nearly a decade of environmental monitoring data shows dramatic changes. The Deer Island treatment plant has participated in numerous peer reviews with other treatment plants around the U.S. and the world, and is much admired for its state-of-the-art operations, which rely significantly on the ability to collect, analyze and store accurate real-time data.



As Duest puts it, "The PI System serves as the solution for better data throughout our operations. Better data equals better plant performance, and better plant performance means a cleaner Boston Harbor and Massachusetts Bay."