

COMPANY

Water Supplies Department,
HKSAR Government

PROJECT

Chlorine generation at Tai Po Water Treatment Works (TPWTW). The chlorine generation is part of the Works under the overall expansion of TPWTW from 400 Million Liters per Day (MLD) to 800 MLD

LOCATION

Tai Po, New Territories

TYPE

Water Treatment Works

SCHEDULED TIME OF COMPLETION

2018

Water Treatment Works Expansion Fast-tracked with BIM

“We could see that with changes made on a continual basis, the model really, really helped” & “Changes could be made over night, and appeared on all drawings - it was quite amazing.”

—Kelvin Leung Siu-kau
Senior Engineer/Consultants
Management, Water Supplies
Department

BIM PARTNERS

Black & Veatch Hong Kong Limited
China State / ATAL Joint-Venture
Electrolytic Technologies



Chlorine Store at Entrance of Tai Po Water Treatment Works
Image courtesy of Water Supplies Department, HKSAR Government

3D model helps design and build Hong Kong's largest on-site chlorine generation plant

In 2013, Hong Kong's Water Supplies Department (WSD) has launched a project to expand Tai Po Water Treatment Works, which will supply 30% of the fresh water supply to Tai Po, West and Central Kowloon, and Central and Western Districts of Hong Kong Island. The plant uses chlorine for disinfection of drinking water. The treated water meets the Guidelines for Drinking-water Quality recommended by the World Health Organisation. Since there are no chlorine gas suppliers in Hong Kong, WSD has been importing liquid chlorine from Guangdong Province, which is transported to the water treatment works for storage and use.

With advancement of technology, chlorine generation facilities have become more mature and reliable. The ever-improving membrane technology in recent years has rendered a chlorine generation plant to be accommodated in more compact space. WSD revealed in 2016 that the chlorine generation facilities are suitable to be installed in the major water treatment works of Hong Kong to do away with transportation and storage arising from importation of liquid chlorine, and thus

eliminating the risk of chlorine gas leakage associated with the transportation and storage of liquid chlorine, resulting in enhancement of the safety of the disinfection operation.

The chlorine generation process produces chlorine gas by electrolyzing brine (saturated salt water) through electrodes that are separated by membranes. The production process is safe and reliable. Chlorine gas will be generated according to the demand and consumed immediately upon production. These are the first large scale chlorine generation facilities to be installed at the major water treatment works in Hong Kong.



On-site Chlorine Generation Skids with Walkways for Operation and Maintenance Access Fitted within Chlorine Store using BIM Model to Optimize Space Utilization
Image courtesy of Water Supplies Department, HKSAR Government

Need for speed and safety

The WSD adopted a strategy for using BIM in 2014, and after some pilot projects they decided to employ BIM for the Tai Po Water Treatment Works expansion as there is a tight time frame - aiming to commence operation in mid 2018. The project is complex, involving safety concerns, tight space constraints, and a need to quickly provide engineering solutions, so instructions can be sent to equipment manufacturers on time.

“The BIM model was developed by and for all stakeholders,” says Stephen Ting, Senior Resident Engineer (Process), Black & Veatch. “They added tanks, pipelines, and details into the BIM models - including sub-models from critical equipment suppliers.”

There were initial doubts within the team over whether the BIM model would work; but there were also champions, saying this was the way forward to milestones and key decisions. Soon, BIM was proving its worth.



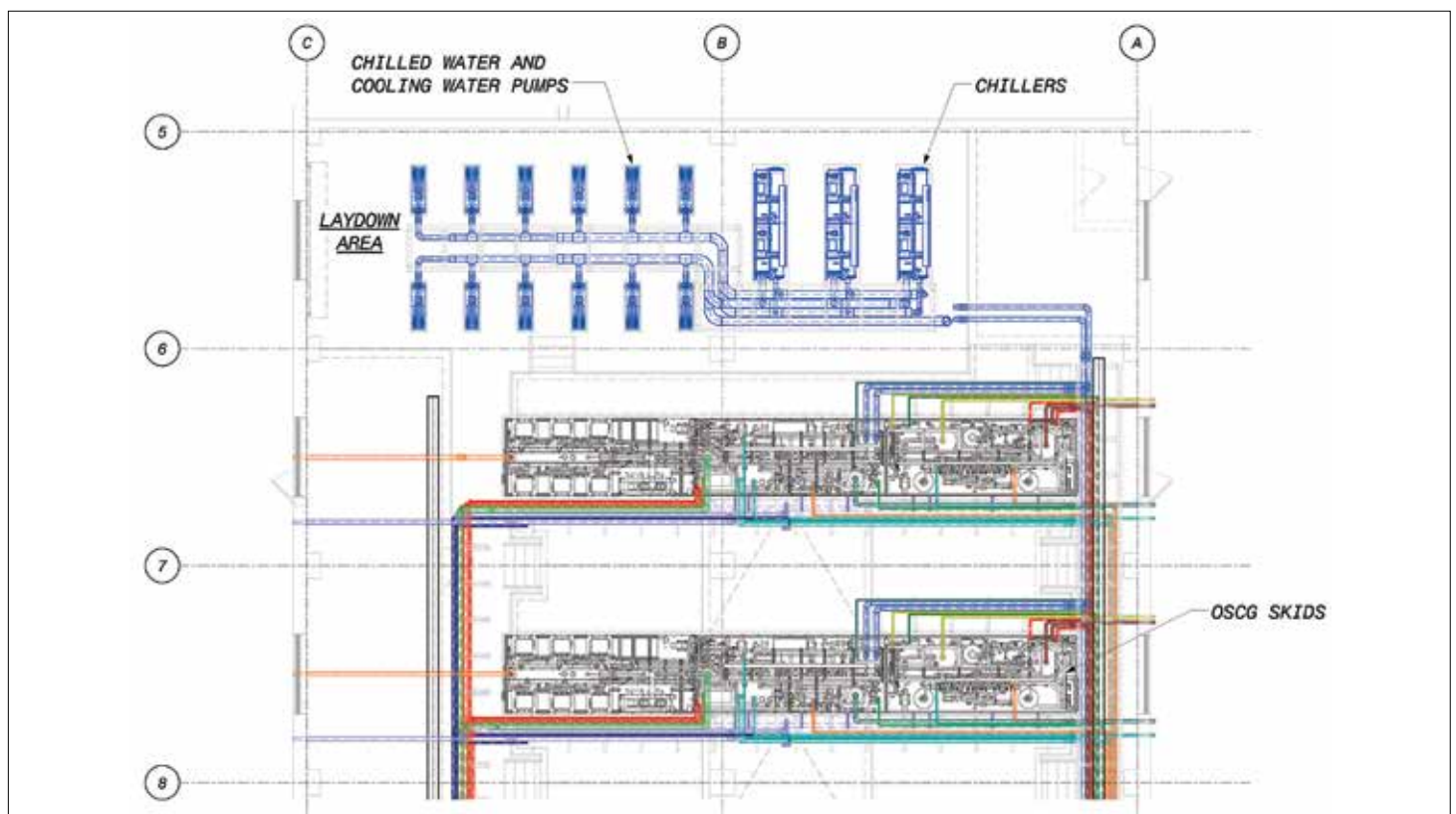
BIM Facilitated Interdisciplinary Coordination involving Mechanical and Electrical Equipment, Piping, Utilities for Building Services, Civil and Structural Design
Image courtesy of Water Supplies Department, HKSAR Government

Enhanced hazard review

The team had to perform a Hazard and Operability (HAZOP) assessment for the chlorine generation facilities, to review the design and help identify any issues. “All stakeholders discuss these issues in a round table meeting room, traditionally using 2D layouts to look at potential hazards,” says Ir. Ting. The required detailed drawings would take considerable time and effort to produce -

which would be especially challenging in this fast-tracked project.

But for the first time, a BIM model was used to carry out the HAZOP. This proved far more effective than the 2D plans for visualising the equipment and space around the equipment, and simulating abnormal conditions. There was less guess work and more focus on solutions. All parties had an overall better experience and time savings. “The



Two Dimensional Layout Plan of Equipment and Piping inside Chlorine Store (Automatically updated with changes from the BIM model)
Image courtesy of Water Supplies Department, HKSAR Government



Visualization of the Access Provided for Operation and Maintenance of Salt Loading Facilities and Brine Tanks
Image courtesy of Water Supplies Department, HKSAR Government

BIM model really speed up the HAZOP considerably,” says Ir. Ting.

The BIM model also helped with more typical aspects of design, such as checking for clashes. A change in the location of a pump could have a major impact on piping, leading to not just clashes but also issues such as operation and maintenance, and could take a long time to assess using a traditional 2D layout. The BIM model slashed the time required from over a week to a few man-hours.

“We could see that with changes made on a continual basis, the model really, really helped,” says Kelvin Leung Siu-kau, Senior Engineer/Consultants Management, Water Supplies Department. “Changes could be made over night, and appeared on all drawings



Visualization of the Elevated Maintenance Access of Hypochlorite Storage Tanks and Dosing facilities
Image courtesy of Water Supplies Department, HKSAR Government

- it was quite amazing.”

David Jackson, Resident Engineer (Process), Black & Veatch, says the model was a great help in coordination meetings: “Some who attended are not familiar with the new plant, but said, ‘Oh, I actually know what this looks like!’”

This in turn enabled maintenance

and operation staff to more readily participate in the design process, and find issues such as adding an access ladder that would impede the access to another piece of equipment. Similarly, staff from the Environmental Protection Department was given a walkthrough of the model, visualising how the new plant would operate. While for Fire Services Department staff who was less familiar to assessing 3D images, the model was used to produce 2D drawings. The flexibility of the BIM model assisted the project team in obtaining permits from government departments.

The project team has also used the model for planning how to install major items such as membrane electrolysis equipment that will be delivered on skid mounts - ensuring there will be sufficient space.

Towards BIM for asset management

The BIM model has helped project team members from various disciplines come together, and deliver the fast-tracked project on schedule for commissioning early next year. The team estimated that using the BIM model reduced the time needed by at least two months.

“Another benefit was the seamless transition from design to construction. The process/mechanical BIM model was handed over to the Contractor for fitting out the balance of plant auxiliaries such as ventilation, lighting, etc.” says Ir. Ting. “The model helps us make prompt

decisions on construction in the tight space.”

Now, thoughts are turning towards asset management, and the WSD is paving the way by building up the as-constructed BIM model and COBie data worksheets with essential operation and maintenance information following completion of the project.

“We’re moving in a direction of using BIM for asset management,” says Ir. Leung. “In the long term, it would be critical for us, as the water treatment industry is very asset-intensive. BIM would be very contributive for the design and construction of new water treatment works.”



水務署

Water Supplies Department



Tai Po Water Treatment Works Located on a Hilltop Overlooking Tai Po Urban and Rural Developments
Image courtesy of Water Supplies Department, HKSAR Government

About Water Supplies Department, HKSAR Government

Water Supplies Department (WSD) is responsible for supplying fresh water and seawater (for flushing) for consumption by Hong Kong's population of 7.3 million for domestic and non-domestic use. In 2015/16, the WSD supplied 982 million cubic metres (Mm³) of fresh water. In the same year, WSD supplied 268 Mm³ of seawater for flushing. As of 1 April 2016, WSD administered 2.91 million water accounts.