

## LOCAL CASE STUDY - Download

# Hach helps drinking water plant customize solution and increasing overall efficiency of system

### Lower Seletar, Singapore

#### Who is the client?

The new 60 MGD water plant in Lower Seletar includes on-site hypochlorite generation for primary disinfection, in lieu of chlorine gas. The disinfection process allows for a utility to develop a flexible alternative disinfection strategy throughout its plant, enabling the facility to further ensure operator and community safety, while reducing hazardous training and meeting regulations concerning DBPs (disinfection by-products).



Figure 1: The 60 MGD membrane drinking water plant in Lower Seletar, Singapore

Singapore is an island city-state, 693 square km, with a population of 5.3 million people. There are some main waterworks on Singapore Island: Chestnut Street, Choa Chu Kang, Woodleigh, Bedok and Bukit Timah. Chlorination or chloramination of finished water has been the typical disinfection practice. For years, these plants have used chlorination and ammoniation equipment, including vacuum operated floor cabinet-mounted chlorine gas feeders, gas ammoniators and chlorine residual analyzers and controls.

#### What is the challenge?

Being a large drinking plant in Singapore and with adoption to the advanced disinfection method, it is very difficult for the operator to fully gain control of the operations.

## What is the process and Hach's solution to client?

Utilities have increasingly begun to evaluate alternative disinfection methods to mitigate the perceived risk associated with using chlorine gas and to reduce the costs associated with implementing it into their facility treatment processes. Utilities have also explored the use of alternative disinfection technologies to reduce the formation of disinfection by-products (DBPs).

Under the membrane filtration stage, Hach has conductivity sensors (test for conductivity), pH sensors (test for pH), ORP sensors (test for ORP), Hach 1720E Turbidimeter (test for turbidity), particle counters, Hach 9184sc Amperometric Chlorine Analyzer (test for chlorine), DO sensors (test for DO) and controllers installed.



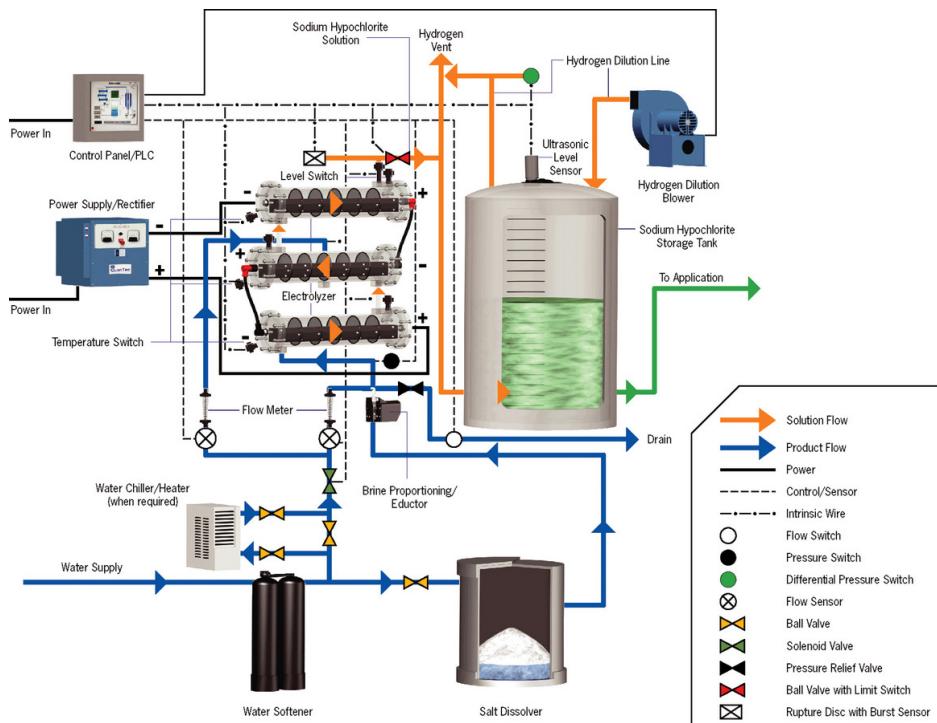
Moving over to the electro-chlorination stage, Hach had the Hach APA6000 HR Hardness Analyzer to test for hardness. Over at the chlorine contact tank, Hach installed conductivity sensors (test for conductivity), pH sensors (test for pH), Hach CA610 Fluoride Analyzer (test for fluoride) and controllers.



Moving on to the process, we have the treated product water, where conductivity sensors (test for conductivity), pH sensors (test for pH), Hach 1720E Turbidimeter (test for turbidity), Hach Amtax sc (test for ammonia), Hach astroTOC UV Turbo (test for TOC), Hach 9184sc Amperometric Chlorine Analyzer (test for free chlorine) and Hach CLT10sc Total Chlorine Sensor (test for total chlorine) are installed.

The clarifier stage, Hach has the conductivity sensors (test for conductivity), pH sensors (test for pH), Hach 1720E Turbidimeter (test for turbidity) and Hach 9184sc Amperometric Chlorine Analyzer (test for free chlorine) installed.

Lastly, at the Lamella Thickener stage, Hach installed the Solitax sc sensor (test for total suspended solids). As follows would be a process diagram for the drinking water plant.



**Figure 2: On-site sodium hypochlorite generation process diagram**

The on-site hypochlorite generation system uses three common consumables in the sodium hypochlorite generating process: salt, water and electricity. The system operates by feeding softened water into a brine dissolver. The salt dissolves to form a brine solution, which is further diluted to the desired salt solution. The salt solution is then passed through electrolytic cells comprising numerous titanium plates divided into arrays of cell packs, each consisting of an equal number of anodic and cathodic plates.

The cell packs are configured electrically in parallel, while the overall cell is configured electrically in series. The cell is fed DC power from a rectifier and electrolyzes the diluted brine into a sodium hypochlorite solution. In simple terms, chlorine is evolved at the anode surface, while hydrogen and hydroxide is evolved at the cathode surface. The secondary reaction of chlorine, sodium and the hydroxyl ion produces sodium hypochlorite at a 0.8% solution. The sodium hypochlorite is stored in a tank until used. Liquid dosing pumps deliver the sodium hypochlorite to the process as needed.

In addition to significant improvements in water quality, the use of on-site sodium hypochlorite generation does not suppress finished water pH to the extent that gaseous chlorine disinfection does. Therefore, the amount of pH adjustment chemical (i.e., lime or caustic) necessary before distribution of finished water is reduced.

This plant is in operation from 2014. Because of Singapore's waterhub reputation for innovation and progressive operations, many other water utilities in the region will be monitoring the Lower Seletar plant. With the promise of cost savings, improved safety and increased reliability, it is likely that use of on-site hypochlorite generation will

continue to grow in the Asia Pacific. As follows would be the large scale on site at the drinking water plant in Lower Seletar, Singapore.



**Figure 2: Installed large scale on-site**

Client used the particle counter in the drinking water post filtration process to monitor breakthrough of microorganism such as Giardia Cyst. ARTI particle counter for optimal monitoring of drinking water. The instrument is universally compatible, has low operating costs, allows stand-alone or network operation and has particle sizes as choices, being 8 optional, 1 fixed size, 2nd optional, programmable fixed or scanning.

Water quality is also judged on the basis of the particle count. Depending on the particle size, this parameter can be monitored cost-effectively and seamlessly with one of the two ARTI particle counter models: with WPC 21 from  $1.3 \mu\text{m}$  or with WPC 22 from  $2.0 \mu\text{m}$ . A special laser diode and a highly sensitive detector determine the particle count and size in a flow cell using the light blocking method. The measurement results are displayed on two measurement channels. The first and smallest size channel is fixed and the balance of the seven sizes, are user selectable.



**Figure 3: ARTI Particle Counter for optimal monitoring of drinking water**

The external mounted sensor can be easily cleaned and the electronics do not come into contact with water. The measurement data is available on a LCD, or via analogue outputs, digital interfaces or limited value transmitter. LEDs show the status of the instrument functions and the sensor and indicate the alarm status. ARTI can be used as a stand-alone instrument with on-site display or can get integrated into a SCADA system. In combination with turbidity meters, ARTI forms the basis for an optimal filtration management system.

### **How is the end result?**

In summary, Hach offers total solution for client with the solution table for list of instrumentation as follows:

<b>Products</b>	<b>Application Point</b>
Conductivity sensors and controllers	Membrane Filtration
pH sensors and controllers	Membrane Filtration
ORP sensors and controllers	Membrane Filtration
Turbidity: 1720E Turbidimeter and controllers	Membrane Filtration
Particle counters	Membrane Filtration
Chlorine: 9184sc Amperometric Chlorine Analyzer and controllers	Membrane Filtration
DO sensors and controllers	Membrane Filtration
Hardness: APA6000 HR Hardness Analyzer	Electro-chlorination
Conductivity sensors and controllers	Chlorine contact tank
pH sensors and controllers	Chlorine contact tank
Fluoride: CA610 Fluoride Analyzer	Chlorine contact tank
Conductivity sensors and controllers	Treated product water
pH sensors and controllers	Treated product water
Turbidity: 1720E Turbidimeter and controllers	Treated product water
Ammonia: Amtax sc with controllers	Treated product water
TOC: astroTOC UV Turbo	Treated product water
Chlorine: 9184sc Amperometric Chlorine Analyzer and controllers	Treated product water
Chlorine: CLT10 sc Total Chlorine Sensor and controllers	Treated product water
Conductivity sensors and controllers	Clarifier
pH sensors and controllers	Clarifier
Turbidity: 1720E Turbidimeter and controllers	Clarifier
Chlorine: 9184sc Amperometric Chlorine Analyzer and controllers	Clarifier
TSS: Solitax sc Sensors	Lamella Thickener

Client's feedback: Client eagerly sourced for Hach's expertise in water quality to provide them with a customized solution to control and ensure their process operations. As such, client is very happy with its performance.

Hach as a world leading water analytical instrumentation provider, works with the client for this new application, tailors and offers a total on-line monitoring solution to this plant, in every key treatment process, ensuring it running smoothly and efficiently.

#### **FOR TECHNICAL ASSISTANCE, PRICE INFORMATION AND ORDERING:**

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