ON-SITE ELECTROLYTIC CHLORINATION (OSEC®) – THE PERFECT CHOICE FOR WATTLE PARK PUMPING STATION

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Abstract

Wattle Park Pumping Station is a located adjacent to an 84 Megalitre reservoir and supplies drinking water to Eastern Adelaide. Wattle Park PS is owned by South Australian Water (SAW) and operated by Allwater.

Part of a recent upgrade to the Wattle Park PS involved providing rechlorination systems at the facility. After listening to the concerns of local residents, SAW decided to install Chlorination facilities that did not utilise Chlorine gas. SAW considered both bulk Sodium hypochlorite and OSEC® and eventually gave the go ahead for duty / standby electrolysers to be installed inside the Wattle Park facility.

OSEC® systems generate a 0.8% solution of Sodium hypochlorite by electrolysing a low strength brine solution. The OSEC® system requires storage of salt in a salt saturator, which provides a brine solution. Water softeners ensure that the feed water to the OSEC® system is free from any hardness. Both the brine and the softened water are fed to the OSEC® at 3% brine solution and electrolysed in the generator. Inside the generator, Chlorine and Hydrogen are liberated at the anodes and at the same time Sodium hydroxide is produced at the cathodes. The Chlorine and Sodium hydroxide then mix to form Sodium hypochlorite.

1.0 INTRODUCTION

The Wattle Park storage tank is a treated water tank that serves the eastern suburbs of Adelaide but also exists as an intermediate storage used for the pumped transfer of treated/desalinated water from the southern to the northern suburbs of Adelaide (North South Interconnections Project). Due to the presence of mixed waters in the storage (treated surface water or desalinated water), an in-tank mixing system and new chlorination facility was required to boost chlorine concentrations but at the same time mitigate taste and odour variations associated with chlorine control. Before the transfer pump station was installed a small gas chlorine plant existed on site but this was undersized for the new required transfer volume of 1,250 L/sec.

2.0 DISCUSSION

2.1 Considerations for the Upgraded Wattle Park

Wattle Park is embedded within a leafy section of Adelaide, adjacent and extremely close to residential properties. Customer perception is important to SA Water and the mandatory signage and high fences associated with gas chlorine installations were not consistent with the aesthetic outcome SA Water were looking for.

Figure 1: ***The Wattle Park Pump Station***

Figure 2: ***The Wattle Park 84 ML Storage Tank***

The increased size of the chlorine gas holdings was likely to raise the attention of Safework SA as the storage volume would exceed the 10% threshold stated in the Major Hazard Facility (MHF) legislation (2500 kg). Safework SA suggested the site would become an MHF if gas chlorine was implemented.

Sodium hypochlorite (12.5%) was problematic mainly due to complications with truck access and traffic management. The site is small and on a steep slope, and frequent smaller deliveries were considered impractical. Sodium hypochlorite (12.5%) has a short shelf life and it was possible that the tank of hypochlorite could go unused for some months. Chlorate, the by-product of hypochlorite degradation is likely to be a regulated compound in the near future.

SAW imports its gas Chlorine and Sodium hypochlorite (12.5%) from interstate. Salt is sourced locally, so reduced transport risk and cost through diversification in supply, combined with safest technology, made electro-chlorination very attractive.

2.2 Selection of Technology

Even though the considerations above provided a strong argument for electro-chlorination, there was debate by operations, with a strong preference for gas chlorine. This was due essentially to familiarity with gas chlorine.

Operations were involved and engaged, at every stage, of system selection, planning and design for the electrochlorination system. Particular attention was given to automating the system to help minimise operator hands-on tasks and maintenance. The electrochlorination system was designed to be duty / standby and to appease operators, an emergency liquid Sodium hypochlorite system was included as well.

Several electro-chlorination systems were considered during the design phase, but OSEC®, from Wallace & Tiernan product range was selected as the preferred system technology.

Figure 3: ***The 92.4 Kg/d B1-200 OSEC® Skids at Wattle Park***

2.3 What is OSEC®

OSEC® is the Wallace & Tiernan trademark for On-Site Electrolytic Chlorination. Typically, this is a system for producing sodium hypochlorite on site and on demand through the electrolysis of a brine solution. It is available in standard unit capacities ranging from 6 to 907 kg of equivalent chlorine per day. The system capacity can be increased by the use of additional modular electrolysers.

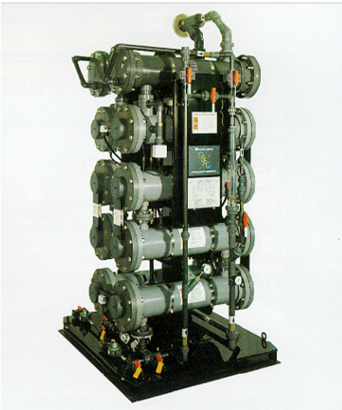

Figure 4: ***907 Kg/d B8-200 OSEC® Skid***

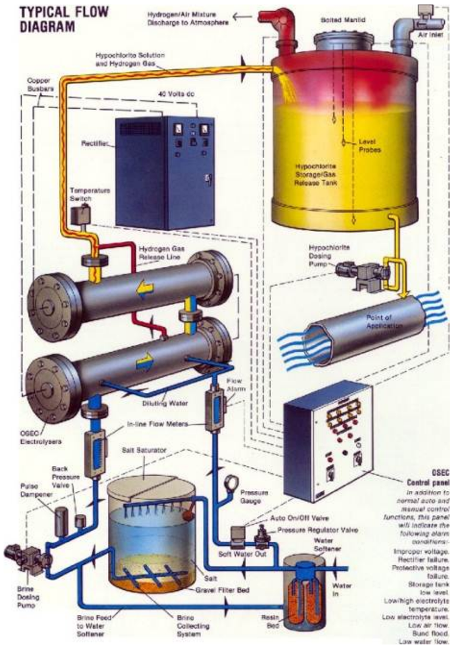

Figure 5: ***Electrochlorination Process***

2.4 How Does OSEC® Work

Supply water passes through the water softener to remove any calcium, magnesium, iron and manganese present. This provides the make-up water for the salt saturator and the brine dilution water. The saturated brine solution is pumped from the saturator by a variable speed metering pump through a flow meter. Accurate brine flow, which is important to establish and maintain efficiency, is achieved with a calibration tube. The softened dilution water flow is indicated at a flow meter with an integral rate valve for adjustment and an integral flow controller to maintain the set flow rate. The dilution water is combined with the saturated brine solution which enters the electrolyser. Within the electrolyser, the brine solution results in chlorine (Cl_2) gas being produced at the positive electrode (anode), while sodium hydroxide (NaOH) and hydrogen (H_2) gas are produced at the negative electrode (cathode). The chlorine further reacts with the hydroxide to form sodium hypochlorite (NaOCl).

When the solution exits the electrolyser, it is approximately 0.7 - 0.9% strength hypochlorite. A float switch and a temperature switch monitor the conditions within the electrolyser to ensure the proper, efficient operation of the system. The hypochlorite solution, together with the hydrogen by-product produced during electrolysis, discharges into a solution storage tank. To ensure that the hydrogen produced is diluted and removed, a blower is used to force vent the storage tank. A flow-sensing orifice, prior to discharge, monitors the airflow. This is interlocked with the system controls to ensure that airflow is established before the electrolysis process is begun. The hypochlorite solution is fed to the point of application by a metering pump. Level probes in the storage tank start and stop the electrolyser to maintain a hypochlorite supply.

3.0 CONCLUSION

The OSEC® systems have been in operation at this site for over a year and a half, and no significant issues have been raised by operations and there is a strong sense of acceptance for this technology, more so than liquid Sodium hypochlorite (12.5%).

The emergency liquid Sodium hypochlorite system, that was included as back-up, has never been used.

SAW would select electro-chlorination for other sites especially at sites where the installation of gas Chlorine would be problematic. The technology has proven itself to be very reliable, has a lesser risk to environmental safety concerns and is easy for operations to operate and maintain.

For operators the main involvement is to unload bags of salt into the salt saturator. Operators also monitor the process by checking hardness of softened water, water temperature, brine strength, chlorine solution strength and rectifier values.

4.0 ACKNOWLEDGEMENTS

South Australian Water
SAW operators