Transition from Ozone to UV Supernatant Disinfection; an example based on reliability and cost factors.

Matthew Brown, Barwon Region Water Corporation

An investigation into alternative supernatant disinfection systems for the Moorabool WTP was undertaken. This was due to reliability and maintenance cost issues with the existing ozone disinfection system. Since February 2012, Ultraviolet (UV) disinfection has replaced ozonation on the supernatant return water at the Moorabool WTP . This poster presents the circumstances, process and outcomes of replacing Ozone with UV disinfection.

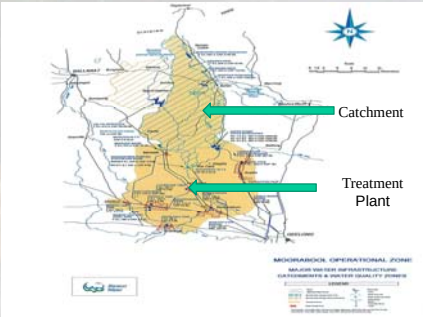
BACKGROUND

The Moorabool WTP was commissioned in 2003. It is a 65ML/d drinking water treatment plant utilizing the dissolved air flotation, and filtration process with disinfection to provide potable water to the greater Geelong region.

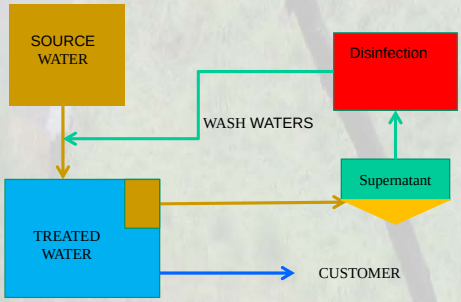
THE PROBLEM

Washwater at the Moorabool WTP is treated and the supernatant is returned to the inlet of the plant. In order to manage the associated water quality risks, the treatment plant was designed with ozone disinfection on the supernatant return.

In the first few years of operation when continuous and high volumes were being treated, the ozone disinfection system functioned reliably. However, as a result of prolonged drought and declining water storages, the plant was subsequently operated at low, intermittent flows and the system became problematic, unreliable and costly to the point where a review of alternatives was warranted.



Catchment and Operational Area

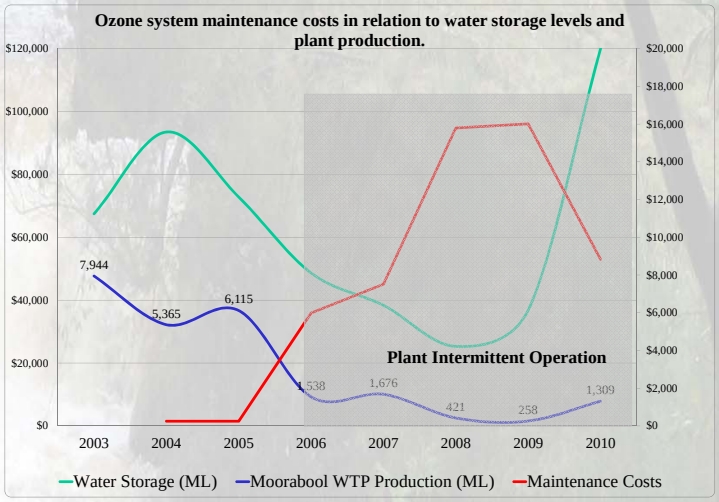


Supernatant Process

THE INVESTIGATION

UV disinfection is widely regarded in the industry as a viable, reliable and cost effective technology for the disinfection of supernatant streams. It was therefore decided to investigate UV disinfection as an alternative to the existing ozonation system. To do so, a selective tender process involving three suppliers was undertaken. Capital, operational, and non –cost data obtained from these tenders were tabulated to perform a detailed analysis to select a preferred UV option.

Based on the analysis, the investment in the preferred UV system was recoverable within three years, with a ten year saving of approximately $136,000. Other anticipated benefits included increased reliability, reduced reliance on ancillary systems, reduced operator intervention required, reduced ongoing maintenance and a more consistent high quality level of disinfection.



Declining water storages and increased maintenance costs.

THE UPGRADE

The Implementation of the new system involved six stages:

1. **Works Planning** focussed on choosing appropriate locations for system components. It utilized an area close to existing power, signal cabling and an above ground section of supernatant pipe. Appropriate safety systems were developed between client and contractors to ensure the safety of all involved during the upgrade.
2. **Physical Works** involved the customisation of a section of the supernatant pipe to fit the UV Unit in-stream. Contingency for future capacity by system duplication was incorporated by providing flanged connection points. Customised frames and cabinets provided adequate weather protection and technologist access.
3. **Electrical Works** were reasonably complex due to the interaction of various components and systems. Citect Scada and PLC programming allowed the full potential of the system to be realised. The UV dose feedback in mj/cm^2 was most important to ensure disinfection performance to the desired USEPA standard of log 3 removal.
4. **Commissioning** was conducted by plant technologists in conjunction with the supplier, electricians and Citect programmers.
5. **Documentation.** As part of Barwon Waters water quality risk management system, Process Control Point information for the UV system was incorporated into the Process Control Manual. This provides operational advice on the potential hazards, control measures, process targets and limits, monitoring procedures, corrective actions, record keeping and notification requirements.
6. **Training.** Theoretical and practical training to plant operators in UV systems was provided by the supplier onsite . Additional formal training was conducted in anticipation of National Operator Competency Standards.

	Ozone	UV
CAPEX investment (initial)	$30,666	$87,905
OPEX costs (per annum)	$26,287	$7,000
- Maintenance costs (per annum)	$14,717	$7,000
- WQ monitoring costs (per annum)	$11,570	$0
Total cost over ten years	**$293,539**	**$157,905**

Summary- Preferred UV Supplier (b) versus Ozone

RESULTS

The new UV system has been operating since February 2012 and has provided all of the anticipated benefits. Operational costs have been reduced, very little operator interaction has been required and a consistent, reliable disinfection has been achieved..

Capital costs were on budget apart from the electrical installation, where the work required was underestimated. These works, which were quite complex, were conducted on a time basis and not subjected to external quotes. It may be prudent for future works of this nature to also be subjected to a more stringent quote based analysis.

The introduction of a complex technology unfamiliar to site operators also created some initial difficulties due to knowledge gap, however this was rectified by obtaining comprehensive and specific training in UV.

UV System as constructed inline supernatant return pipeline.

CONCLUSION

The problems associated with the supernatant disinfection system were initially identified by operator feedback and increasing maintenance spending. This led to a structured and detailed investigation using a tender process to identify viable alternatives. Careful planning allowed for financially prudent and safe implementation of the new technology with minimal disruption to plant operations or unforeseen problems. This has resulted in a more reliable and cost effective disinfection mode for the supernatant return stream at the Moorabool WTP.