a PASS

Problem Accepted - Solution Supplied

2013 WINNER

W-I-O-A Australia EXCELLENCE IN OPERATIONS

An award providing opportunity for water industry operational staff to share their in the field innovations & fixes to problems so that others in the water industry can benefit.

AQUA LIFT PACIFIC

PASS

Problem Accepted - Solution Supplied

Objectives of the Award

- To create an opportunity which encourages water industry operational staff to share their in-the-field innovations and/or fixes to problems so that others in the water industry can benefit.
- To provide an application process which is easy to complete and utilises a standard template. This will give all water industry operational staff the same opportunity for presenting their innovation.
- To provide the opportunity for operational staff to receive recognition for their innovation and efforts.
- To encourage operational staff to become aware of and involved with the Water Industry Operators Association of Australia (WIOA).
- To allow WIOA to share the good ideas and innovations with other Members through the Operator magazine and/or other publications.

The Process

The PASS application template and more details on the Award can be found on the WIOA website www.wioa.org.au/awards/PASS.htm or from the WIOA office.

Judging

All PASS applications received in the 12 month period ending 1st March annually, will be assessed by an independent panel on a number of criteria, including:

- Commonality of the problem
- Benefit to OH&S, water quality, and the environment
- Financial and sustainability benefits
- Application to other industries
- Uniqueness, adaptability and simplicity

Reward

The person who submits the PASS application deemed best in that particular year will be announced the winner of the PASS Award at the WIOA NSW Conference. Aqualift Pacific will provide sponsorship of $2000 for the winner to join the WIOA team on their annual operational tour of New Zealand including attendance at the New Zealand WIOG operations conference.

Contents

Installing a reservoir circulation system including chlorine infusion and monitoring.

Terry Randall & Danny Roberts,
Port Macquarie Hastings Council

THE PROBLEM

We have a large, newly constructed concrete reservoir that is not fully cycling due to limited customer demand. The new reservoir is 13ML and was constructed as part of water augmentation plan to cater for future urban development. Chlorine residuals are difficult to maintain and regular manual dosing is required. We had previously fitted a directional nozzle to the inlet to keep the water moving, but because the tank only fills every second day or so, the momentum is quickly lost.

How did the problem impact you or your work situation?

Water operators had to manually dose the reservoir to maintain water quality. Twice a week staff would climb the reservoir and add chlorine. This high frequency of manual dosing was required due to inadequate mixing of the 40 metre diameter reservoir, location of the entry hatch close to common reservoir inlet / outlet and short circuiting of the reservoir via the common inlet/outlet. The problem caused multiple impacts including high labour and chemical cost, WH&S issues associated with climbing reservoirs / manual chemical dosing, localised damage to ladder, hatch and structure from chemical attack and water quality concerns.

Slug dosing of Reservoir

Cloud of chemical visible causing localised corrosion issue around hatch and internal ladder, inadequate dispersion of chlorine in reservoir, safety concerns with climbing ladder, working at heights, chemical handling and operational cost.

How long had the problem been occurring?

It has been occurring since commissioning of the reservoir and is expected to remain an issue until the demand increases (projected 20+ years). In the interim we have experimented with many operational changes to try and find a happy medium, including changing reservoir levels and installing the directional inlet nozzle.

Directional nozzle inside reservoir.

Circulation pump discharge

Pipe-work with Chemical Injection Point and Bypass, and Sample Points

THE SOLUTION

We had considered various 'in tank' mixers, but they are all relatively expensive to purchase, install and maintain. We heard about externally mounted pumps by asking around other water operators and also internet research.

Who helped work on the solution?

The project team involved was Terry Randall (project supervisor), Danny Roberts (operator supervisor), Bevan Hudson (mechanical installation) and Murray Thompson (former water manager) and we decided to trial an externally mounted pump, coupled with a chlorine injection and water sampling points

Describe the solution.

Our workshop made up a swivel mounted fixture to hold the internal jet nozzle in place and to also allow it to be adjusted for angle and direction once it was in operation. The jet nozzle currently is set in the same direction as the larger nozzle unit fitted to the inlet. We had our local divers fit the internal HDPE pipework while the tank was operating. This involved fixing two separate 50mm HDPE pipes into the tank, running them over the wall and back down to the ground. A circulation pump draws water from the foot valve in the reservoir and recirculates it through the nozzle. We can also inject chlorine into the system after the pump. The nozzles can be swapped over to trial different water quantities and pressures once it is operating and our disinfection residual data begins to stabilise. The cost so far has been minimal - 40 meters of 50mm PN 16 HDPE pipe, some elbows, a foot valve and wall brackets and fixings. We reused a pump we had in storage and constructed the chlorine dosing system in house. We also installed 4 sampling points as a way of measuring the results of the project.

Recirculation pipe work mounted on external reservoir wall.

How has it helped you at work?

The system has multiple benefits

1. Circulate the reservoir to maintain water quality across the entire volume of water (no more dead spots)
2. An effective and controlled chlorine dosing system
3. Elimination of chlorine "short circuiting" and problems related to slug dosing
4. Elimination of a working at height risk involving manual chemical handling and transfer
5. Elimination of corrosion issues related to slug dosing of reservoir
6. Reduced chemical cost achieved by effective chlorine dosing
7. Reduced labour cost as operators can complete testing and chlorination adjustments quickly (no longer required to climb ladder)
8. Accurate sampling regime to ensure water quality across the entire reservoir.

Suggest improvements.

New tanks could incorporate this system in the design. This system could also be used for other water treatment processes. We are currently looking at using this system for a CO_2 dosing point for pH correction.

We also considered tapping into the rising main, upstream of the inlet motorised valve and having a 50mm pipe feeding constantly into the tank. In certain installations, a pump may not be required by utilising a tapping point upstream of the inlet motorised valve. This system would be very inexpensive to operate having a nil power cost but would need an automated valve to close off should the reservoir become full.

We think this is a very simple solution to tanks that are not turning over sufficiently. This system addresses many problems associated with slug dosing reservoirs, along with safety benefits and better water quality control.

Circulation pump.

Changing from ozone to ultraviolet disinfection: based on reliability and cost factors.

Matthew Brown, Barwon Water Corporation

THE PROBLEM

Ozone disinfection units were used to mitigate the water quality risks associated with supernatant waters being returned to the head of the plant. As a result of a prolonged drought and declining water storages, the plant was operated at low intermittent flows and subsequently the Ozone system became problematic, unreliable and costly to a point that a review of alternatives was warranted.

How did the problem impact you or your work situation?

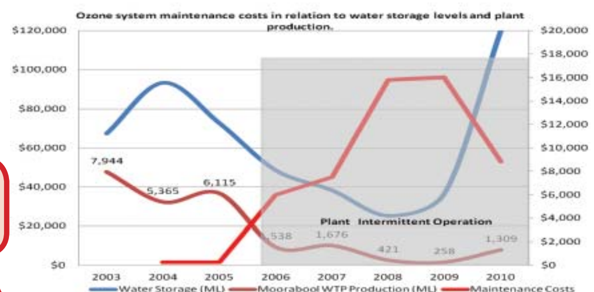
The problem created operational, financial, and to some extent, relationship issues with the equipment maintenance contractor. Constant operator intervention was required to try and keep the system operational. Due to being a "no release to environment" site, it became a limiting factor in operations because un-disinfected water required storage and management in the wash water lagoon system which has a finite capacity. The relationship with the maintenance contractor also became strained due to repetitive failures in maintenance and repair works with no clear and concise cause for the reliability issues identified. High repair, maintenance and possible replacement costs were adding up in an ever tightening budgetary environment.

How long had the problem been occurring?

2-3 years in a progressively worsening nature.

Ozone generators and oxygen production unit.

The system relies on multiple ancillary systems such as oxygen production, air supply, electrical supply water pumps and injectors.
Greater complexity = more things to go wrong!



The relationship between plant intermittent operation and increasing costs.

THE SOLUTION

Constant recording, feedback and communication from technologists to team leaders on operational difficulties and maintenance information coupled with a basic analysis of water quality and cost data created an all encompassing picture of the problem.

It was decided that the problem was at a stage which warranted further analysis to identify a solution. The analysis involved careful consideration of alternative technologies and how they could be incorporated into our system. The alternative technology chosen was Ultraviolet disinfection.

A tender process based on our requirements captured cost, specification and operational data which could be compared with the existing Ozone system. The results of the analysis indicated the cost of the new system was recoverable within 3 years and a 10 year operational saving of approximately $136,000 may be achieved.

Operational, maintenance, and water quality factors were also considered and evaluated by tabulating and rating each factor. When all the information was bought together there was a standout solution which could not be ignored.

Who helped work on the solution?

It was a whole site treatment team approach. From identification of the problem, looking at solutions and implementing the solution, everyone played a part. The senior process engineer and other leaders worked on what alternative technologies were available, the specifications we required along with the tender process, system requirements, financial analysis and training gaps. Technologists provided practical feedback on design and controlled the installation of new equipment. This included a works and safety plan, contractor inductions, supervision and advice.

Basic cost comparison.

	Ozone	UV
CAPEX investment (initial)	$30,666	$87,905
OPEX costs (pa)	$26,287	$7,000
- maintenance costs (pa)	$14,717	$7,000
- WQ monitoring costs (pa)	$11,570	$0
Total cost over 10 years	**$293,539**	**$157,905**

Describe the solution.

The solution was to change disinfection technologies from Ozone to UV disinfection. A new site for the disinfection equipment was chosen to allow direct installation to the supernatant stream pipeline. It also had close access to existing communications and power supply arrangements and was easily accessible to the operators and contractors which all helped to reduce costs and improve works safety.

The new UV system has less reliance on ancillary systems than Ozone generation, reducing the risk of possible faults and disruption to operations. It also provides reduced ongoing costs and a smaller environmental footprint.

Suggest improvements.

Improved UV disinfection performance could be obtained by producing lower turbidity supernatant from the wash water clarifier. Upgrading this system to reduce floc carryover could help but is not vital.

Duplication of the system initially rather than later would provide higher grade disinfection to Log -3 removal at higher supernatant turbidity's but is not warranted at current flow rates.

This exercise displayed how careful and methodical planning can allow for financially prudent and safe implementation of a new technology with minimal disruption to plant operations or unforeseen problems. Everyone has different skills and ideas which can be bought to the table to provide positive solutions. Do it Right First Time!

Installed UV system.

Modified pipe work and flanges to allow above ground installation to existing pipe work & future capacity for duplication if required. Simple system reliant on electrical supply only. Less complexity = less things to go wrong!

Installing ultra-sonic algae control units in a basin with fluctuating water level.

Glenn Jeffrey, Wannon Water

THE PROBLEM

To control algae in one of Warrnambool's raw water basins we decided to install ultra sonic algae control units. There is an aerator on the basin that has submerged support and power cables which ruled out boat access to the basin to dose algaecide.

There was one major issue with installing ultrasonic units. The water level varies by 1-2 metres and can fill quickly (within two days). To work effectively and prevent damage, the ultra-sonic units must remain submerged and positioned in the correct direction. Therefore, installing these units using the conventional mounting method posed three issues.

1. Compromising of the basin lining
2. Damage to the units as they may come out of water if the water level drops to low levels
3. Inability to service the units when the water level is high

How did the problem impact you or your work situation?

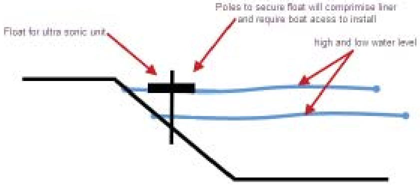
After discussions with the supplier it was clear that the conventional mounting methods would not work in this basin. The conventional method requires a constant water level with a shallow and flat basin floor to mount the units. This system is more suited to lakes and fish ponds.

A new method was needed that would allow the units to maintain position, float on the changing level and allow access for maintenance from the water's edge.

How long had the problem been occurring?

Blue-Green Algae blooms had been an issue with this basin for many years. The aerator that was used to mix the basin was undersized and made little difference to the algae populations. The aerator's cables prevented boat access for algaecide dosing. So the ultra-sonic alternative was chosen.

Conventional mounting system.



Conventional mounting system proposed by manufacturer.

THE SOLUTION

After discussions with the supplier, we designed a new way to use the floats. This involved making a boom system to hold the float in place while allowing access from the shore for maintenance. Since the post for the boom is located on the shore, this would not compromise the basin lining.

Who helped work on the solution?

Arthur Kokolekos (Royce Water Technologies) assisted with the concept design. A prototype was made using parts from the local hardware shop. After trialling the prototype for two weeks the other three booms were made. The booms are made from aluminium, copper and stainless steel to minimise corrosion issues.

Describe the solution.

The boom is fixed to the shore via a pivot point on a post so it will sit at the high water level and is long enough to reach the low water level mark. The other end of the boom is fixed to a copper pipe which can rotate to allow the float to remain level on the water at all times. The float also is held in position via two anchor lines which maintain the ultra-sonic unit's direction (see photos and schematics below).

This system allows the ultra-sonic units to remain submerged regardless of water level. The rotating copper pipe allows the float to sit flat on the water regardless of weather conditions (wind 55kmh or more and waves 30cm high are common). The boom has also allowed the units to be serviced without the need to get into water.

How has it helped you at work?

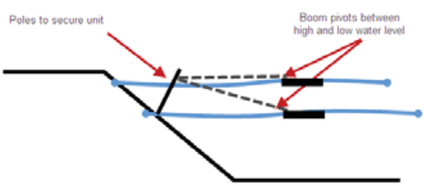
This boom system has created a reliable and robust mounting system for the ultra-sonic units. The ultrasonic units remain functioning at optimum conditions regardless of the weather conditions or basin water levels. It has removed many Occupational Health and Safety issues as the units can be accessed on the shore without the need for boats or wading into water. This mounting system has allowed the ultra-sonic units to reduce algae levels, with no major algal blooms since installation.

Suggest improvements.

After 18 months in operation the only parts which needed replacement were galvanised washers which were replaced with thick aluminium plate washers. The anchor lines were also replaced as proactive maintenance.

This boom system was made using parts from the local hardware shop. This made them very cost effective (about $50 each) and quick to assemble. However if I was to install the ultra-sonics at another site I would like to talk to a fabricator about making most of the components out of aluminium to reduce weight and prevent corrosion. These booms have withstood some very extreme weather conditions without failure. They have proven to be a simple way to install small equipment in basins with varying water levels and sloping sides. This boom/float arrangement would be ideal on lined storages where the liner cannot be compromised.

Our mounting system.



Close up of boom and float.

Float switch in off position to reduce risk of ultra sonic operating out of the water & failing at low water level.

Our mounting system with solar power unit.

Reservoir chlorine tablet dispenser.

Stuart Singleton, Shoalhaven City Council

THE PROBLEM

Chlorinated water was contacting the reservoir's metal roof sheets when adding new tablets to the canister.

How did the problem impact you or your work situation?

Chlorinated water was corroding the metal roofing sheets of the reservoir.

How long had the problem been occurring?

Around six months on another reservoir. The canister was placed on a tray to prevent chlorinated water contact.

THE SOLUTION

Instead of using a tray to prevent chlorinated water leaking from the canister and contacting the roof, using a pin to suspend the canister above the reservoir allowing any leaking water to stay inside the reservoir made sense.

Who helped work on the solution?

- Fabrication Shop Ulladulla
- Shoalhaven City Council

Describe the solution.

By placing a pin through frame and canister, it prevents water contact on roof sheets and holds the canister in place so new tablets can be inserted.

How has it helped you at work?

Prevents chlorine water contacting roof sheets. Reduces roof sheet maintenance and it is quicker to insert tablets.

Suggest improvements.

Considering changing the canister size to make smaller and lighter but everything else works fine. A simple solution but very practical.

Water savings on hydraulic centrifuge pump/ motor for cooling.

Peter Tolsher, North East Water

THE PROBLEM

High water usage consumption in running water through hydraulic motor for cooling purposes and not being able to use reuse water as an alternative due to the effect of corrosion on the system.

How did the problem impact you or your work situation?

High water usage and charges.

How long had the problem been occurring?

Since the upgrade of the system in 2002

THE SOLUTION

Thought about how we could reduce the water consumption and still maintain a reliable system to keep motor cool.

Who helped work on the solution?

Site staff at the West Wodonga WWTP. Adrian Rijnbeek and Chris Keith

Describe the solution.

We put in a 10,000 litre tank which is filled with fresh water on a ball float. We fitted a small pressure pump with a flow rate of 1 litre per second that feeds the hydraulic pump on the centrifuge to keep the motor cool and the water is circulated back to the tank. This created a high water temperature in the tank so we used the tank water to feed the polymer make up system and the water used in this process was replenished by the town water supply to keep the water cool.

How has it helped you at work?

The site water consumption was reduced by approximately 30 kl per day. The operation of the dewatering system is 8 hours per day 5 days a week. This made a cost saving of around $70 per day or $18,200 per year and the outlay to fund the project was about $5,000.

Suggest improvements.

Should have thought about it earlier.

Keeping the Hydraulic motor that runs the centrifuge cool.

System works.

Sand recirculation pump valve replacement

Richard Stiffel and Mark Oliver, Goulburn Valley Water

THE PROBLEM

The problem was that the isolation valving on the sand recirculation pumps at the Shepparton tertiary treatment plant had failed.

How did the problem impact you or your work situation?

The valves are designed to allow the isolation of the lamella tank and contents so that inspection, repairs and maintenance of the sand pumps can be carried out without the whole contents of the tank spilling onto operators when doing repairs or inspections. The failure of the valves meant that general maintenance and repairs to sand pumps, along with clearing of blockages in the pump head, or the delivery or discharge ports of the pump, was impossible without first shutting the plant down and draining the lamella tank.

How long had the problem been occurring?

This problem was caused by a gradual degradation of the valving over a period of years. This wear was not identified during normal inspections because it was occurring inside the valve body. The fact that the valves would not seal was not picked up for a period of time was because the valve was not normally shut outside of the normal maintenance period for the pumps.

THE SOLUTION

A solution was reached after some initial research by operators followed by consultation with Goulburn Valley Water engineers and others with knowledge of other industries where similar pumping applications may be in place.

Who helped work on the solution?

- Central waste water operators
- Goulburn Valley Water engineers with advice from consultants
- Valve suppliers

Describe the solution.

After consultation between operators, management and engineers it was decided that a like for like replacement was not a viable long term option. Different designs and types of valves were considered but it was decided to go with pinch valves commonly used in the mining industry. These valves are rubber lined and have some resistance to the residual sulphuric acid and ferric sulphate chemicals in the pumped liquor as well coping with the abrasive nature of the sand in the pumped liquor.

How has it helped you at work?

This new style of valve being constructed of more appropriate materials has greater resistance to abrasion and residual chemical, is easier to monitor and allows a free flow of material through the valve reducing turbulence. This in turn results in reduced wear on the valve and internal surfaces of the associated pipework. Another positive is that because there are no metallic internal parts there are no worries about corrosion. By installing these valves we can now isolate a pump, carry out repairs quickly without waiting hours to drain down the tank then carry out repairs.

Suggest improvements.

With hindsight there was "if time permitted" an opportunity to also evaluate the type of pipe associated with the valves. Possibly there could have been a pipe with more resilience to the internal wear caused by the abrasiveness of the pumped material.

There could have also been an opportunity to determine if the flow meters in the pipework were fitted in the appropriate position in relation to valves, flanges and bends.

DAFF air dispersion revamp

Wesley Wilkie, Goulburn Valley Water

THE PROBLEM

The Shepparton Water Treatment operators found that during poor raw water quality conditions the Dissolved Air Flotation Filtration (DAFF) plant was unable to treat water to meet the Drinking Water Quality Standards. This was caused by poor air dispersion through the bullhorns.

How did the problem impact you or your work situation?

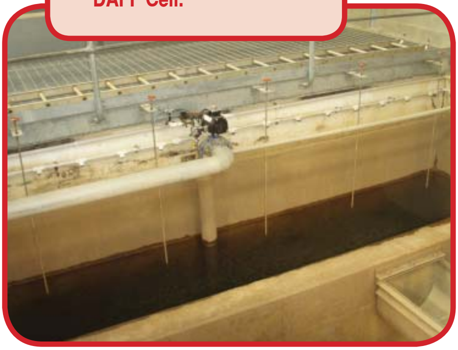
During poor raw water quality events we were unable to treat water that exceeded 50 NTU and 100 True Colour before filtered water NTU increased to unacceptable levels. Water supply would be affected if we had poor raw water in high demand periods.

How long had the problem been occurring?

The DAFF plant was built 1998 so for the last 14 years we have been experiencing this problem in times of poor raw water quality.

Shepparton DAFF.

DAFF Cell.



Old Air Dispersion Pipe.

Old Bullhorns.

THE SOLUTION

Goulburn Valley Water (GVW) appointed a consultant to investigate the issues associated with the DAFF. After going through the report and several meetings and group discussions with GVW operators we all agreed that the main issue was the air dispersion through the bullhorns.

Who helped work on the solution?

The Shepparton water treatment operators mainly came up with the solution, however a consultant and a local Engineer all helped as well.

Describe the solution.

After talking to a local engineer we trialled a few different bullhorns to see which ones would give us the best air dispersion blanket. With the existing bullhorns, there was 6 across the whole filter. Now there are 24 single outlets every 250mm across the width of the air dispersion chamber. With this design we are able to get an even curtain of milky air dispersion. In the past you could see streaks of water without saturated air. The globe valves were down sized from 1 inch to 3/4 inch to allow the operators to have more control with air dispersion and minimise the pea size bubbles and the train was extended to cover the full width of the chamber.

How has it helped you at work?

We now have the ability to treat water up to 130 NTU and 200 colour. We have also been able to make sure that we can supply water which meets the Drinking Water Quality Standards through poor raw water quality events.

Suggest improvements.

These works should be implemented into all new designs. GVW is looking into doing the same works at other existing DAFF plants. Part of this submission is to make designers and asset owners aware of how things can be improved.

New bullhorns.

New air dispersion pipe.

DAFF cell with new valves

Trial bullhorns.

Milky air dispersion even across the DAFF cell.

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