WATERWORKS

OFFICIAL JOURNAL OF THE WATER INDUSTRY OPERATORS ASSOCIATION

DECEMBER 2002

NOBODY KNOWS LIME LIKE WE KNOW LIME.

DAVID MITCHELL LIMITED
125 YEARS
MANUFACTURING
LIME PRODUCTS

125 years ago, a Scottish stonemason called David Mitchell began mining limestone at Lilydale in Victoria.

Today, the company that bears his name still leads the field in all aspects of lime production.

Quicklime, hydrated lime, agricultural lime, limestone and a host of other products are supplied to a vast range of clients from strategically placed plants around Australia. Lime is truly an infinitely flexible mineral.

Today, we do more than dig limestone. Indeed, we do much more than refine and sell it. David Mitchell Limited is a priceless resource of engineering and scientific knowledge on how to use lime. Our technical service personnel also advise on lime plant construction, slaking operator training and plant management throughout Australia and neighbouring countries.

New uses for lime are regularly discovered, particularly in the fields of conservation, environmental protection and water treatment.

If the question is lime, the answer is simple. David Mitchell Limited is at your service.

To find out more,
visit us at

www.davidmitchell.com.au,
ring 03 9285 4822 or
fax 03 9285 4810.

LIMIL

DML144

DAVID MITCHELL LIMITED
P.O. Box 383 Box Hill, Victoria, 3128

WaterWorks

Editorial Committee

Peter Mosse, Editor
mossep@gippswater.com.au

Russell Mack
mackr@gippswater.com.au

George Wall
GeorgeW@gvwater.vic.gov.au

Direct mail to:
WaterWorks Editor
c/-Peter Mosse
Gippsland Water
PO Box 348,
Traralgon, Vic 3844

Advertising & Production
Hallmark Editions
PO Box 84, Hampton, Vic 3188
Level 1, 99 Bay Street, Brighton, Vic 3186
Tel (03) 9530 8900 Fax (03) 9530 8911
Email: hallmark@halledit.com.au

WaterWorks is the publication of the Water Industry Operators Association (WIOA). It is published twice yearly as a bound insert in *Water Journal*. Neither the WIOA nor the AWA assume responsibility for opinions or statements of facts expressed by contributors or advertisers.

Contributions Wanted

WaterWorks welcomes the submission of articles relating to any operations area associated with the water industry. Articles can include brief accounts of one-off experiences or longer articles describing detailed studies or events. These can be e mailed to a member of the editorial committee or mailed to the above address in handwritten, typed or printed form. Longer articles may need to be copied to CD and mailed also.

President's Prattle

Another year almost gone! The old adage that "the older you get the quicker the years go by" seems to be all so true!

As 2002 ends it is a time to reflect on what has happened over the past year and to look forward to the year ahead. The terrorist attacks have affected us all in one way or another. Our industry plays a vital role in the community and thus, could become a target for some unscrupulous people. We as operators of water and wastewater systems need to be ever vigilant, to ensure that the services that we provide are not compromised in any way.

In 2003, WIOA intends to continue to develop the services provided to its members and aim to increase our member numbers from all over Australia. We request that you do your bit to support the growth of WIOA by spreading the word about the services and benefits we provide.

Please enjoy this edition of WaterWorks, make the most of the coming festive season with your loved ones and family, and have a safe and merry Christmas and a Happy New Year!!

Russell Mack, WIOA President
December 2002

CONFERENCES, COMMUNICATION and COOPERATION

Many of the articles in this edition are taken from operators conferences around the country, from the Annual Victorian Water Industry Engineers and Operators Conference held in September each year to regional AWA Operators Interest Group workshops and conferences.

Conferences are a way for information to be passed amongst members of likeminded groups. The Water Industry Operators Association (WIOA) is no exception. Perhaps more important than the actual papers and posters themselves is the opportunity to meet people and talk about common interests and problems. Contacts made at conferences and workshops enable operators to establish effective communication networks. These networks provide a valuable resource that benefits the industry as a whole by allowing operators to pick up the phone with confidence and talk over problems with those that may have been through similar problems before. These contacts may also facilitate visits to other Authorities and further exchange of information. We are after all one industry, with limited resources, so the ability to share information is essential. Each Water Authority cannot tackle and solve all its problems in isolation.

Conference presentations are also a way to assist in the professional development of operational staff. Most find the idea of presenting a paper quite intimidating, however preparation of a poster is much less threatening and can be a way of sharing some of the good things that have been done in your Water Authority or alternatively to warn others of some of the pitfalls experienced by your business. This magazine offers a further way to pass on good ideas, and even the not so good, to the rest of the industry.

So, to all Operations Managers and CEO's within the industry why not consider actively involving your operational staff in the range of conferences available and encouraging some individuals to prepare posters or short articles for this magazine or for operators conferences? Why not include this as a requirement in a work plan or performance plan for some of your operators?

Communication only occurs if the message gets to the intended audience. We are still having trouble getting this magazine and information about WIOA out into the field. Can you help achieve this in some way????

Peter Mosse
December 2002

CONTENTS

Comment 3
Trialling the Deskin Quick Dry Filter Bed for Biosolids Reduction 4
pH Measurement in Low Ionic Strength Drinking Water 7
Commissioning of Australia's Largest Nitrogen Removal Plant 8
STP Filtration Back on Track 10
Pass for P.A.S.S. on OH&S and Treatment 12
Use of a Novel On-Line Instrument to Investigate the Impact of Trade Wastes on a UV Disinfection System 16
Removing Algal Tastes and Odours from Drinking Water 18
In Brief 21
Conference Report 22

TRIALLING THE DESKIN QUICK DRY FILTER BED FOR BIOSOLIDS REDUCTION

Anthony Evans

Judged Best Paper at the 65th Annual Victorian Water Industry Engineers and Operators Conference 2002

Introduction

South West Water Authority (SWWA) has trialled a number of alternative methods of handling biosolids produced at the Warrnambool Waste Water Treatment Plant (WWTP).

Originally the option of long-term storage was considered to be the number one choice but if this option was to be pursued the cost of transport would be a major hurdle to overcome. Drying the sludge to a higher percentage solids at the WWTP would be advantageous in reducing these costs so a number of options were reviewed.

Different types of belt press, filter press, and centrifuges were all considered and a trial of a filter press from Germany performed in 1999 still did not produce a satisfactory result in cake dryness and consistency. A problem associated with the Warrnambool sludge is the high fat and grease content in the influent from dairy factories and abattoir waste, which create slow drainage rates on belts and filters.

Details of a different type of drying bed in America came to the attention of the authority and a study was undertaken to assess this system for our use. Results of 30%-60% dry cake in 3 days were enough to convince those involved in a trial of the potential of the system.

Figure 1. Deskins Quick Dry Filter Bed.

Deskins Quick Dry Filter Bed

The Deskin quick dry filter bed system was sourced by SWWA. Construction began in December 2000 with completion in early February 2001.

In appearance the bed looks no different to the Australian version but the difference is in the drainage system and under bed construction.

The "quick dry" filter bed consists of four major components.

- A series of pipes are laid on the base of a bed to provide drainage and also presaturation water to enter the bed prior to pouring on the sludge. These pipes are then covered with 20-25mm rock. A honeycomb grid is placed onto the base rock and filled with 10-15mm rock and a final layer of sand is spread over this to complete the bed.
- A Flocculation system (RapidFloc Mixer).
- An in-line polymer preparation system that injects polymer into the flocculation device.
- A self contained harvesting unit.

The operating principle of the Deskin bed is to:

- Thicken sludge to 1.5%-2%.
- Presaturate the bed from underneath with clean effluent to a set level.
- Pour the Waste Activated Sludge (WAS), flocked with polymer, into the water to a set level.
- Turn off the WAS and immediately open the drain valve.

Saturation of the bed forces out any air that has been trapped in the filter media and allows the sludge to flow evenly across the bed surface to achieve maximum distribution.

When the underdrain is opened a vacuum or siphoning effect is created and causes the rapid dewatering of the sludge. Along with this, cracking or "opening up" of the sludge occurs and allows air to circulate around the cake and further increase drying. Around 90% of the water will exit in 12 hrs and the sludge will

Figure 2. Dried Solids Harvesting Unit.

continue to drain while it is on the bed.

Initial results produced a cake of 45%-60% dry but during this stage of testing temperatures were 38-40ºC and load rates were low with sludge of .8%-1.0%. The trial continued with mixed results and it became evident that we would have to change some of the factors governing the testing.

Problems With The Bed

During our trials a few problems were encountered. The original sand provided excellent drainage but poor retrieval due to the harvester sinking into it and picking up sand as well as cake. When tests were carried out, drainability and stability had to be taken into account to determine our needs. Some sands were similar to the original and mixes were tried until a compromise was found with a supply from a local quarry.

Polymer was another issue along with dose rate as it is mixed and added without any ageing and totally controlled by the mixing unit.

During the full scale trials it soon became apparent that a different approach to the trials was needed, since if a trial pour was unsuccessful, up to 7 days elapsed before the cake was harvested and the bed prepared for another pour.

Troubleshooting

It was decided to make scaled mini beds out of 80L plastic containers. In these containers different sands could be trialled along with varying doses and different types of polymer until consistent results were being achieved and we felt confident with the process. These trials could all be carried out at the same time and turn around times depended on the tests being carried out, but were no longer than 3 days.

After these tests were carried out larger containers of 1m x 1m were made up and placed onto the bed on the different types of sand with sludge poured in to simulate an actual pour. All of the tests were carried out using every piece of equipment supplied to mix and dose with the sludge bypassing the bed and returning to the plant with buckets used to transfer samples to the containers.

After tests had been carried out the following points were identified.

• Coleraine sand provided good drainage and stability.

• Zetag 7878FS40 polymer was equivalent to that supplied by Deskins.

• Mixing of WAS to 1%-1.5% worked but more air was needed in the mixing tank to provide a consistent sludge %.

• Velocity across the bed needed to be higher to provide a more even spread.

Figure 3. Mini trial drying beds.

After identifying these problems a pipe was connected to the WAS line that feeds the belt press and a flow of 22 L/s was pumped onto the bed which is the maximum limit of the flocking unit.

With the flow velocity, polymer and sand type all identified as problems and rectified, trials could now be done on the bed.

Full Scale Trials

When trials finally started on the Deskins bed everything worked as we had come to expect from the smaller tests, much to the relief of the operators. The next major problem that started to appear early in the testing we had no control over at all. Rain! For 10 pours in a row anywhere between 25mm and 40mm of rain was recorded on the cake as we tried in vain to dry it. Even with the rain on the cake a higher % result than the belt press was achieved although the 7 days taken to reach this result was not all that desirable.

Changes were also made to the original method of pouring WAS into the water and draining at the finish of the pour.

No pre-saturation at all was tried, and then a small amount of up to 100mm was found to provide the best result for even and rapid spreading. After this initial spread is achieved draining at a rate similar to the inflow will create a river effect and spread sludge to the entire bed for an even coverage. At around the 4 hr stage the draining slows and sludge addition is stopped to allow the bed to finish draining.

Tests were carried out daily to determine dryness along with current weather conditions and rainfall

Conclusion

After extensive trials with different components and trips to observe the operation of this system overseas, the Warrnambool trials have created a benchmark for Deskin in Australia. For the period of the trial we have experienced the coolest summer along with the longest period of rainfall for our area. Even with these elements against us we were able to obtain quite pleasing results even though the time factor for some of these was unsatisfactory. The trials have been completed and SWWA is continuing to evaluate and trial a range of other systems for biosolids reduction.

The location of our plant in proximity to the sea could be seen as a disadvantage to the drying process as it is usually cooler than inland and the sea spray is evident on all vehicles and plant windows suggesting moisture uptake in the drying cake. A location to the north of the Dividing Range would therefore be a location that could sustain a drying bed of this type given that the weather is more settled in the warm to hot range suitable for drying.

Public awareness of the problem of biosolid production should be on the agenda of all Water Authorities Australia wide as it is a problem that will more than likely be with us for a long time to come.

We all contribute to the impact on the environment in some way so it would seem logical to pay a small price now to lessen the impact in later years.

Acknowledgements

Dave Deskins, Deskins Quick Dry Filter Bed; Paul Darvodelsky, Pollution Solution & Designs Pty Ltd; Gary Anderson and Tim Tutt, South West Water Authority.

The Author

Anthony Evans (aeva@swwa.com.au) is a Water and Wastewater Quality Officer with South West Water Authority in Warrnambool, Victoria.

pH MEASUREMENT IN LOW IONIC STRENGTH DRINKING WATER

Phil Edwards

"Which type of pH electrode is most suitable for use in drinking water or surface raw waters"?

This is a question I get asked frequently and the answer really depends on a number of factors.

The difficulty in measuring the pH of drinking water is that the ionic strength of much of our potable water in Australia is relatively low. Hence there are fewer hydrogen ions than in other surface waters around the world and in other types of water like wastewater. The lower the ionic strength, the more easily the pH value can be affected by external influences, the main problem being the effect of CO_2 from the air. The CO_2 dissolves in water to produce a weak acid known as carbonic acid. Accurate *and* rapid measurement in drinking water presents one of the toughest challenges for electrode design.

pH measurement is essentially an exchange process where hydrogen ions from the sample pass through the membrane of the electrode and ions from the electrolyte pass out through the membrane into the sample. Faster Electrodes have a higher flow and require refilling more often whilst those that have a lower flow respond to changes in pH more slowly but will last longer without refilling.

Basically there are two common types of pH Electrode, the All Glass type and the Epoxy Body type (with internal glass). pH electrode manufacturers usually offer a number of different options in terms of the design of the 'diaphragm' which controls the flow of electrolyte solution through the diaphragm.

The All Glass Type Electrode is the ideal choice for water measurement on the laboratory bench where conditions are controlled. The platinum diaphragm, a common and proven membrane in these types of electrodes is ideal for drinking water applications because it provides consistent controlled flow of electrolyte. Another electrode type that is even more effective is one that allows an adjustable flow and contains a *ground diaphragm*. The method of adjustment will vary depending on the manufacturer. These electrodes usually require refilling from time to time and electrolyte solution must be added through the filling hole. Be careful however NEVER to immerse the electrode at any time, below the filling hole, which should always remain OPEN during measurement.

To maximize the speed of response, ensure your sample vessel is near full and preferably covered (ie use some foil with a hole in the top). A gentle consistent stirring of the sample will also aid in shortening the equilibration time. Always allow some minutes for the electrode to sit in the sample before taking a reading. This is to allow the internal electrolyte to come to the same temperature as the sample and to allow the ion exchange process to take place.

The Gel Filled electrode is a good 'all rounder' but basically more suited to field measurement. It has the advantage of not requiring electrolyte replenishment, but will respond more slowly in low ionic strength water than the All Glass refillable type. This is because the electrolyte flow through the fibre mesh membrane is more uneven, the electrolyte being in Gel form. However many customers still prefer this type of electrode for drinking water field measurement due to its robust outer coating and convenience, particularly if the cable and temperature sensor are integrated in a waterproof design. It should be stressed that these electrodes are still made of **glass** internally and can therefore still break if not handled with care!

Design improvements in these gel filled electrodes has resulted in faster responses in low ionic strength water, so shop around and try different types, you may well find electrodes from different manufacturers will perform faster than others. Always remember to compare your results, because a fast electrode may not necessarily be an accurate electrode!. Accuracy in pH measurement is best assured by keeping the sample conditions as close as possible to the calibration conditions, with particular attention to minimizing the difference in temperature.

So, which one is best for you ? If robustness and convenience are of paramount importance then the Gel Filled electrode is a good compromise. If speed of response, is the most important factor, then the All Glass refillable electrode types are the way to go.

The Author

Phil Edwards (philip@merck.com.au) is Product Manager with Merck Australia

COMMISSIONING OF AUSTRALIA'S LARGEST NITROGEN REMOVAL PLANT

Ross Smith and David Solley

Judged Best Paper at the Water Industry Workshop Brisbane, 2002

1. Background

Luggage Point WWTP was originally commissioned in 1981 and featured primary settling followed by a conventional activated sludge process. The plant was designed for complete nitrification only. A second stage of the plant, using essentially the same process configuration, was commissioned in 1993. Stage 1 of the plant has a nominal capacity of 600,000 EP (126 ML/d ADWF) and Stage 2 a capacity of 300,000 EP (63 ML/d ADWF). The current license requirements for the effluent are 20 mg/L BOD_5, 30 mg/L TSS and 30 mg/L NH_4. The plant typically averages an effluent total nitrogen of 27 mg/L.

In the early 1990's concerns were voiced that the rapid population growth in the South East Queensland area had the potential to impact adversely on Moreton Bay. The Moreton Bay Catchment Water Quality Management Strategy was published recommending a reduction in the level of nitrogen discharged via wastewater into the bay.

2. Project Objectives

The objective of the first phase upgrade of the plant was to achieve an effluent total nitrogen of 8mg/L by 2001. Implementation of this phase involved modification of the existing plant, without constructing any new tanks.

3. How Nitrogen Removal Has Been Achieved

The 5 stage Bardenpho biological process was selected to achieve the required nitrogen removal since this process configuration allowed the best use of existing tanks (Figure 1). The process establishes two different reaction zones in the bioreactor for biological nitrification and denitrification.

In the nitrification process, the ammonium in the wastewater is oxidised to nitrate. This is carried out in the aerated zones of the bioreactor, where dissolved oxygen is freely available. In the denitrification process the nitrate is reduced to nitrogen gas. This is carried out in the unaerated zones, which are usually mechanically mixed to keep the activated sludge floc in suspension. The denitrifying bacteria require food (also known as carbon or substrate), which is limited at Luggage Point and is one of the project challenges.

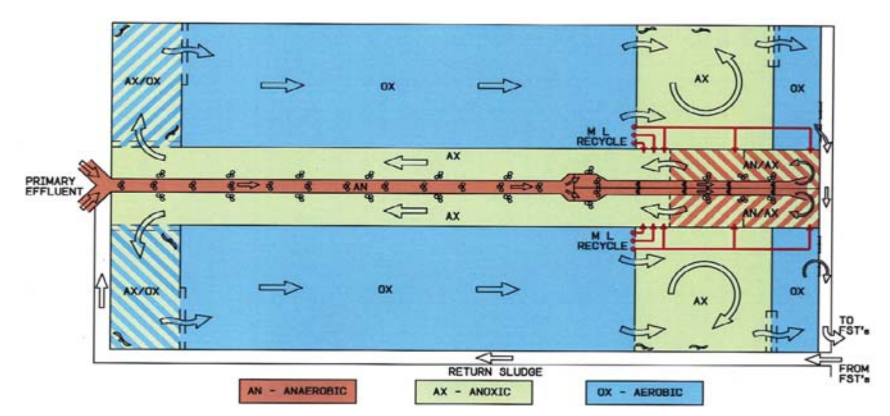

Figure 1. Five stage Bardenpho bioreactor layout for Luggage Point WWTP nitrogen removal upgrade.

Significant flexibility has been incorporated into the design through the inclusion of variable volume anaerobic, anoxic and aerobic zones. Table 1 provides typical fractions for these zones. One of the aerated zones has been fitted with membrane diffusers which can be turned off and mechanical mixing started. Therefore the zone can be operated in either an aerated or non-aerated mode. The ability to direct the mixed liquor recycle to one of three non-aerated zones has allowed these zones to operate in either anoxic or anaerobic zones. Large operating ranges have been provided for the mechanical equipment, to increase flexibility.

Table 1. Bioreactor zone fractions for Luggage Pt WWTP.

Bioreactor Zone	Fraction (% of total)
Anaerobic	3.5
Anaerobic/anoxic swing	4
Primary anoxic	15
Anoxic/aerobic swing	7.5
Primary aerobic	50
Secondary anoxic	15
Secondary aerobic	5
Total anaerobic fraction	3.5 - 7.5
Total anoxic fraction	30 - 41.5
Total aerobic fraction	55 - 62.5

A high level of control and on-line instrumentation has been included in the first phase of the upgrade, including on-line nutrient analysers (for ammonia and nitrate at various locations through the bioreactors), ORP meters, multiple aeration zones with individual DO control, sludge blanket measurement and flow measurement.

Solids are now wasted directly from the mixed liquor rather than from the RAS, and thickened using a DAF. The primary settling tanks have been retained and the primary solids thickened by a rotary screen. The combined solids are anaerobically digested and biogas from the digestion used by on site generators to provide up to 60% of the sites energy requirements.

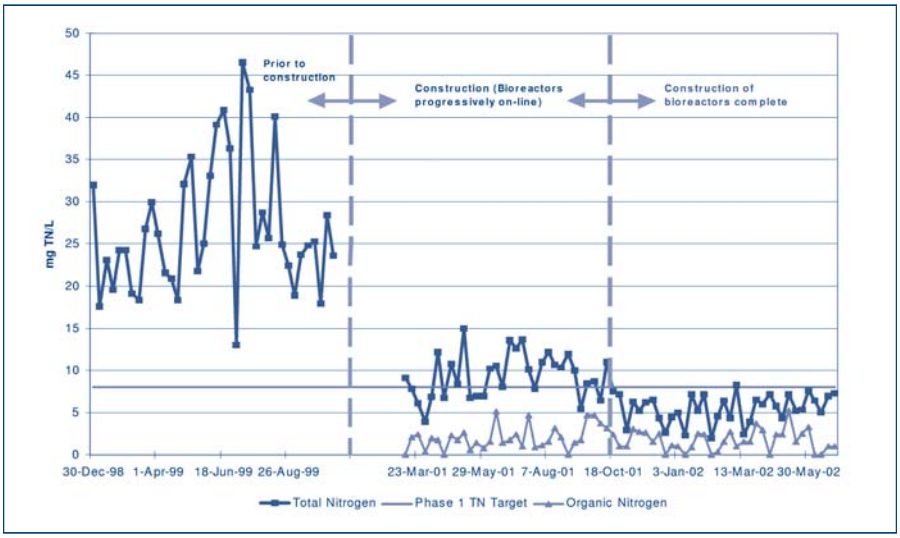

Figure 2. Effluent nitrogen for Luggage Point during construction and commissioning.

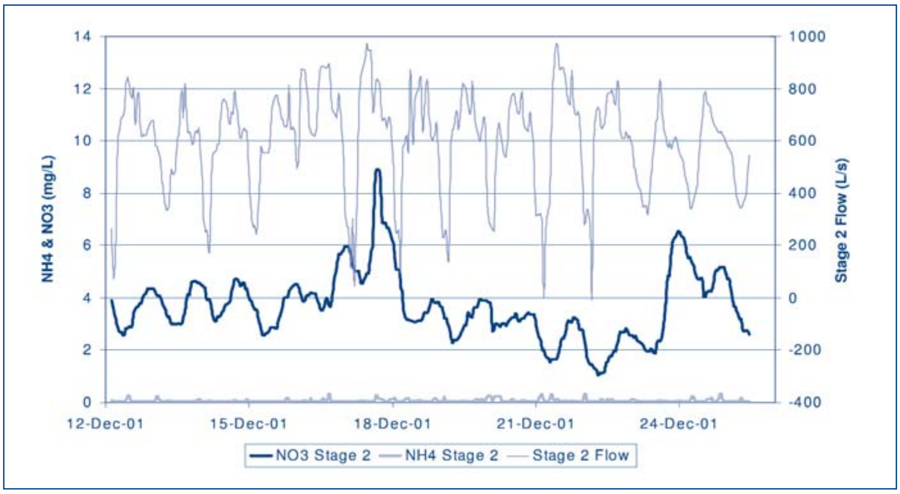

Figure 3. On-line nutrient analyser trends showing weekly nitrate variation.

4. Performance

Preliminary results (Figure 2) indicate that the average effluent total nitrogen has been reduced below the first phase target of 8 mg/L. The plant now removes approximately 6 tonnes of nitrogen per day, which would otherwise have entered Moreton Bay. During the staged construction of the upgrade, the plant was loaded to approximately 75% of design capacity, with one third of the plant off-line at times. This presented many operational challenges, but through careful management of the treatment process and construction activities, the upgrade was completed without breach of the existing effluent licence (20:30 for BOD5:TSS). The use of precast concrete walls for the new internal baffling was of great assistance to the speed of construction.

The process has also been operating with good stability and excellent sludge settleability, as indicated by an SSVI generally less than 120 mL/g since commissioning. This is likely due to the long plug flow anaerobic selector provided in the upgrade bioreactor layout, specifically installed to improve the sludge settling characteristics. Scum has also been well controlled using the selective wasting of scum with the waste mixed liquor solids to the DAF.

Further optimisation and stress testing of the plant is required for the completion of the first phase project. One interesting feature of the effluent results is the weekly variation in nitrate levels, which shows a distinct peak following each weekend (refer Figure 3). This is probably due to a weekly imbalance in the TKN/COD ratio, where during the weekend, there may be insufficient substrate available for denitrification. It is anticipated that this will be overcome through better control of the process and utilisation of the available substrate, including endogenous substrates. Addition of an external carbon source such as methanol, is also an option that has not been trialed to date.

By focusing on the management of the biological process, the operational staff were able to achieve an average suspended solids result of less than 10 mg/L during the two year construction period. Periods of instability did occur occasionally, where the levels reached between 10 mg/L and 25 mg/L. This was due to plant overload when extra tanks were off-line as a result of equipment failure. During these periods, the operators alleviated adverse performance by reducing peak flow rates into the plant through storage of wastewater in the gravity sewerage system. In addition a settling aid was dosed to the mixed liquor flowing to the final settling tanks. This effectively prevented the sludge blanket in the final settling tanks lifting over the outfall weirs and into the bay.

5. Conclusions

The plant has been upgraded and commissioned without breach of the existing licence requirements, through careful and skilled management of the treatment process throughout this period. Optimisation of the process is continuing to reduce the effluent nitrogen to even lower levels. Future upgrade phases will be required to achieve the 5mg/L effluent total nitrogen target by 2005, as recommended by the Moreton Bay Strategy.

6. Acknowledgements

The work and support of all members of the Brisbane Water project team and Luggage Point WWTP operators is greatly appreciated.

The Authors

Ross Smith (TPO55bw@brisbane.qld.gov.au) is the Shift Operator Process Improvement Coordinator at the Luggage Point STP in Brisbane.

Cover Photograph

The cover photograph shows Warragul Sewage Treatment Plant Operator Graeme Beasley preparing to dose lime into the plant bioreactors. Lime is dosed daily to maintain a satisfactory alkalinity and pH for the operation of the plant.

STP FILTRATION BACK ON TRACK

Michael Bonanno

Judged Best Operator Paper at the NSW Operators Conference, Penrith, 2002

Quakers Hill Sewage Treatment Plant (STP) is Sydney Water's second largest inland STP, discharging an average of 32 ML/d of tertiary treated effluent into Breakfast Creek. The EPA regulates the effluent quality in order to protect the aquatic environment of the Hawkesbury/Nepean River System. Work has recently been completed to improve the reliability of four Travelling Bridge Filters, resulting in improvements in treatment performance and saving millions of dollars in deferred capital.

Filtration is an important process for the removal of phosphorous, suspended solids and faecal coliforms from wastewater. Quakers Hill STP's licence requires all flows up to 900L/s to be filtered. The aim is to produce an effluent with an average total phosphorous of 0.05mg/L (year to date performance is 0.03mg/L). Four dual media filters and four travelling bridge filters (TBF) comprise the filtration process. For over ten years the TBF have been very unreliable. The dual media filters alone are capable of producing high quality effluent during dry weather, however quality has traditionally been compromised during wet weather.

In 1989 four TBF's were built to supplement the four dual media filters. A TBF is a down-flow, single media, shallow bed filter that is broken up into many individual cells. The main advantage of the travelling bridge filter over a dual media filter is that filtration capacity is maintained during backwashing while still producing an effluent quality adequate for wastewater applications. The backwash system is mounted on a bridge, which travels slowly along the filter, backwashing each cell individually. The filter backwash operates by pumping filtered water through the sand bed into each individual cell. A wastewater pump takes the dirty backwash water out of the filter into a waste channel.

Since commissioning, the TBF's were plagued with problems. Two major problems were bridge derailment (Figure 1) and sand migration (Figure 2). Bridge failure can lead to a series of other problems such as damage to limit switches, rails, wheels and bearings. Each time a derailment occurred, the filters had to be taken offline for extended periods to be repaired. The sand migration problem occurred as a result of some sand being dragged to one end of the filter during each backwash. After numerous backwashes the accumulated sand at the end would prevent the bridge from reaching its limit switches and so cause damage to wheels and rails, as well as derailment. The two major problems were very much inter-related.

After years of reacting to near daily problems two options were considered. One was to demolish the TBF's and install four additional dual media filters, which would incur a high capital cost. The second option was to take a less expensive, in-house approach to discovering and addressing the root cause to these problems and establish reliability of the TBF's. The in-house optimisation approach was given priority over the rebuild approach. A small team of planning staff, production officers and maintenance workers were introduced to the TBF problems in December 2000. A brainstorming session was conducted to identify all possible causes for the inherent problems. It was believed that derailment could be avoided by investigating the alignment of the bridges and axles. A maintenance crew was assigned to check

Figure 1.

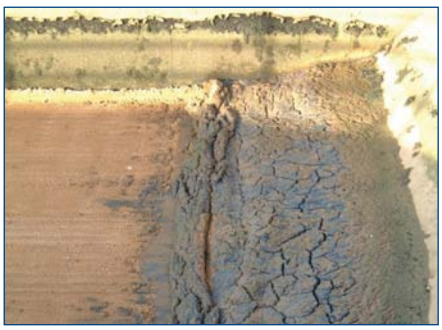

Figure 2.

and adjust the alignment of the drive system.

After the bridges were realigned, they ran for several weeks without misalignment. However, problems with sand build-up were still causing the wheels to climb the rails on some of the bridges. This was not observed at other TBF installations. The wheel shape was compared to other Sydney Water STP installations and the cross sectional shape of the wheels was found to be different. It was believed that an H-shaped wheel would completely eliminate any derailing.

A new wheel was manufactured and installed and the alignment was checked and rechecked. Figure 3 shows the old wheel on the left and the new H-cross section on the right. This work was completed by June 2001. This work was successful since no further derailments have occurred. The elimination of the derailment problem was an important milestone for this project because it allowed other operational issues to be addressed without the threat of derailing.

The filters were now able to run for weeks without stopping. The only problem was that after a few weeks, sand would build up on the ends and prevent the bridge from reaching the limit switches, causing damage to the wheels and rails (Figure 4). It was unknown how this would be solved so the first thing was to check if the filter was operating according to the design.

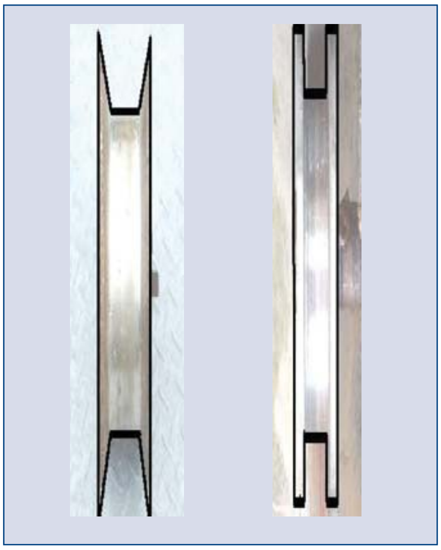

Figure 3.

Figure 4.

The waste water and backwash pumping capacity was designed to be 11L/s. The original pump size was 11L/s and the actual pumping rate was found to be 3.5L/s. It is believed that head losses in the system were incorrectly calculated resulting in undersized pumps. A filter was selected to trial a pump designed to pump 30L/s. Modifications to the filter were required to accommodate the larger pumps. After installation the pump flowrate was found to be a maximum of 13L/s, which can be turned down by the operator. The problem with sand migration was reduced when compared to the filter with the undersized pumps. As a result, all the backwash and wastewater pumps were replaced. This work was completed in March 2002.

Overall the work has been successful in improving filter reliability. As a result of TBF reliability improvements, Quakers Hill STP is able to reliably achieve high quality effluent under all weather conditions. Full credit goes to the Production Officers at Quakers Hill STP for their operational support and problem solving skills, Sydney Water's Planning Team for providing technical support and finances and our maintenance staff for solving problems with wheels and alignment, and, for making the modifications required to install the new pumps.

As a result of this cooperation and determination, filtration at Quakers Hill STP is now BACK ON TRACK!

The Author

Michael Bonanno (michael.bonanno@sydneywater.com.au) is Production Officer at the St Mary's STP in Sydney.

PASS FOR P.A.S.S. ON OH&S AND TREATMENT

Sandy McGregor

Once in a while it happens, you are tasked to address a specific issue but as you proceed to work through the alternatives you find that you have opened up a can of worms.

Take for instance a relatively small job to remove the risk of back and musculoskeletal injury to the operator as a result of being required to manhandle bags of lime on a day to day basis. Well!

- Start with an OH&S issue to be resolved.
- Finish with a complete change in the primary chemicals used and total replacement of the chemical dosing equipment.

This article describes the work involved and the advantages found using PASS (Poly Aluminium Silicon Sulphate) as an alternative coagulant to lime and alum.

Back Ground

The Mirboo North Water Treatment Plant (WTP) is located in the Strzelecki Ranges of central Gippsland and supplies water to the town of Mirboo North.

The plant has a capacity of 25L/sec and involves a mixture of process modules. First in line is a modified clarifier which provides both a floc growth zone and a sedimentation area. The dosed water then flows to a Dissolved Air Flotation (DAF) unit, and then to a dual media filter before distribution to the customers.

Prior to the works carried out to address the manual handling issues the plant operated using a traditional alum and lime chemical regime, with poly being used as a filtration aid. Historically the plant produced good water that met the Australian Drinking Water Guidelines. Occasionally, due to poor performance of the DAF and the high chemical demands during dirty raw water events, the plant had to be turned off for short periods.

OH&S Problems

The operator of the plant was required to lump 25kg bags of lime, in order to refill the lime feeder. This had the potential for serious injury. To resolve this problem, three options were considered.

- Installation of a vacuum bag lifting aid. This option was ruled out due to the lack of head room required for such a device.
- Installation of a vacuum materials transfer unit to remotely fill the day hopper from ground level. This option was ruled out due to the high cost and the lack of suitable units.
- Change the lime for a more user friendly alkali in liquid form such as 10% soda ash solution. This became the option of choice.

The Investigative Stage

To determine if soda ash was a suitable alternative, technical staff from both Gippsland Water and the local chemical supplier Aluminates P/L, carried out jar test trials with soda ash and a range of coagulants. It was determined that alum and soda ash did not perform well enough to proceed with a simple change over from lime to soda ash. This was due to poor colour removal.

The jar tests revealed that excellent product water quality could be achieved using a relatively new product to Gippsland Water, PAC23 (Polymerised Aluminium Chloride). Floc size was smaller

Figure 1

than normally required but no upfront pH correction was needed and the coagulant dose was reduced by a factor of 10. “The answer was found” and a plant trial was commenced.

Well! Jar test results are often different to actual plant results and performance. The floc size produced in the plant was considerably smaller than that in the jar test. This resulted in unacceptable loads being placed on the filter. It was also found that due to the high concentration of the PAC23 and the very small dose rates required, the automatic turbidity control of the dose rate was inappropriate. The result was the abandonment of the PAC23 trial at the plant.

A brief period passed, Aluminates made available some of a new product they were tinkering with as another alternative to alum and PAC23. “The PASS.” ‘PASS’ is a Polymerised Aluminium Silicon Sulphate compound. This coagulant forms its own floc without the need for turbidity, and, in low alkalinity waters. Jar test trials commenced straight away. PASS has an unusual side effect. You can’t dilute it before applying it to your sample, else it will floc out even in distilled water. This required the used of very accurate syringes to add the PASS neat to the sample jar. To do this a set of 200uL gas tight Gas Chromatography syringes were purchased.

The results were outstanding! A floc with properties that suited the less than ideal process perfectly. Plant trials followed with excellent results.

The PASS in action

This is where the operator’s fun began. Not only was he required to run his plant using chemicals he had little experience

Figure 2

with, he was trialling a chemical which to our knowledge had not been used in water treatment in Australia.

The preliminary trial was set up using a basic dosing system consisting of a pump, a carboy (at first) for storage, an isolation valve and a calibration tube. After identifying that the PASS worked in the plant and that the product water quality improved by the end of day one, a larger quantity of PASS was ordered and the long term trial commenced. Figure1 shows the second variation of the temporary dosing setup with the old alum dosing panel in the back ground.

It was noted that the floc size was larger and lighter than when alum and lime were in use. The result was an increase in the amount of floc that passed onto the DAF. Previously with the alum and lime this would have caused problems, but the advantage of PASS was quite obvious in the DAF stage. The floc laden water enters the DAF unit by spilling in from a height of about 600mm above the normal water level. This causes the formed floc to be broken up. Previously with the alum and lime combination, the floc would not reform sufficiently for the DAF to perform correctly. The PASS floc on the other hand was not broken up as easily and reformed very rapidly with excellent bubble retention. This resulted in increased floc removal in the order of 75% to 80% verses 10% previously. The filter inlet turbidity values went from 3 to 5 NTU to <1.5 NTU over night. Filter run durations were able to be extended from 15 hours to 26 hours and the filter aid poly dose was eventually reduced to a third of its previous dose rate.

It was found that the PASS dose was in a similar range to the alum dose enabling the automatic turbidity response control of the dosing to be used. This control scheme is a means of adjusting the dose rate of the coagulant based on a historical table of starting point dose rates for given raw water turbidity. The control system enables the operator to quickly get on top of the rapid changes in turbidity experienced by the plant during times such as in the middle of the night.

A further advantage of the new coagulant to the operation of the plant has been its ability to cope with higher than previous inlet turbidity, due to the improved performance in the solids removal capacity of the DAF.

In addition, the residual aluminium levels leaving the plant have dropped to <0.09 mg/L even with an unexpected overdose of 300ppm of PASS. Both the chlorine demand and the alkali demand have decreased as a result of the change. This has been due to PASS's ability to form a viable floc at low alkalinities. Also a less than expected quantity of soda ash is required to correct the pH to the desired values. The reduced residual aluminium levels and reduction in product water turbidity from 0.09 NTU to 0.03–0.05 NTU has also resulted in the subtle change in chlorine demand.

The big change over

Despite the increased chemical cost of the PASS system (approximately 80% increase) the decision was made to go ahead with the changeover for three reasons. The use of PASS

- Could be achieved at a lower capital cost.
- Completely removed the manual handling problems
- Improved water quality
- Provided simple operation and greater flexibility in response to varying raw water quality.

All sounds simple doesn't it?? The success of the trial came to an abrupt halt when the PASS started crystallising in the dosing line and dosing failed. Shortly after that the soda ash started crystallising. Solids and diaphragm pumps don't mix very well.

We had thought about the issue of temperature because of problems we had experienced previously with alum and soda ash crystallisation at other plants. However we were assured by Aluminates that PASS was used in Canada without problems. But yes the cooler weather had arrived and no PASS doesn't like cooler weather. We can only assume that in the colder climates it is taken for granted that these sorts of chemicals need to be stored inside and dosed through heated dosing lines

Fortunately the building of the outside bund and new storage tank had been delayed for a number of reasons. A rethink was required. Well if chemicals needed to be stored in doors we would do just that. If the dosing lines needed to be heated we would do that. Water Treatment Plants run in countries where snow is on the ground for several months. We weren't going to let the chill of a Gippsland winter stop the project!!!

The temporary chemical storage tanks where moved in to the building. The original out door storage proposal was scrapped and a new internal storage bund was drawn up.

But how to keep the system operating on a day to day basis?? Heat tracing was discussed but our service provider Transfield came up with a rapid temporary fix. The chemical dosing lines where fitted with a warm water jacket, with warm water supplied from an old kitchen urn found in the back corner of the work shop. This was fitted with a float valve to maintain the water level and an inline recirculation pump to push the water through a rubber hose fitted over the dosing pipe. Figure 2, shows the partially completed chemical bund and the temporary hot water urn on the wall.

Figure 3, shows the final hot water system installation including, the temperature control cabinet, the converted hot water service, the gravity feed tank and inline recirculation pump.

This worked well and solidification has no longer been a problem.

The early days of the colder weather were a trying time for the operator. During this period the operator was repeatedly called out at all hours of the night. On occasions it was reported that he even got to the point where he attended the plant in pyjamas and dressing gown rather than getting dressed each time!!!

The change from dry lime to liquid soda ash required an all new dosing system and the change of the alum to PASS could not be made with the existing dosing arrangement. This resulted in an entirely new dosing panel designed to allow for redundancy in the PASS and Pre Soda Ash dosing, a new poly dosing system and an all new filtered water pH correction dosing system.

Previously the pH correction occurred at the coagulation stage and on occasion resulted in a less that optimum coagulation pH value. The split in the pH correction points enables the coagulation pH to be maintained at optimum without the customer knowing. All in all a good pass for PASS. Figure 4 shows the new chemical dosing installation.

Figure 3

Figure 4

Acknowledgements

Thanks to Peter Mosse for initiating the project and supporting the PASS trial. A big thanks to Wayne Smith the operator at the Mirboo Nth WTP for living through the trials and installation and retaining his sanity. Thanks also to Bob Rowley of Transfield for coming up with the temporary hot water fix and the design of the new system.

The Author

Sandy McGregor (mcgregors@gippswater.com.au) is a Water Treatment Technologist with Gippsland Water.

USE OF A NOVEL ON-LINE INSTRUMENT TO INVESTIGATE THE IMPACT OF TRADE WASTES ON A UV DISINFECTION SYSTEM

Peter Mosse

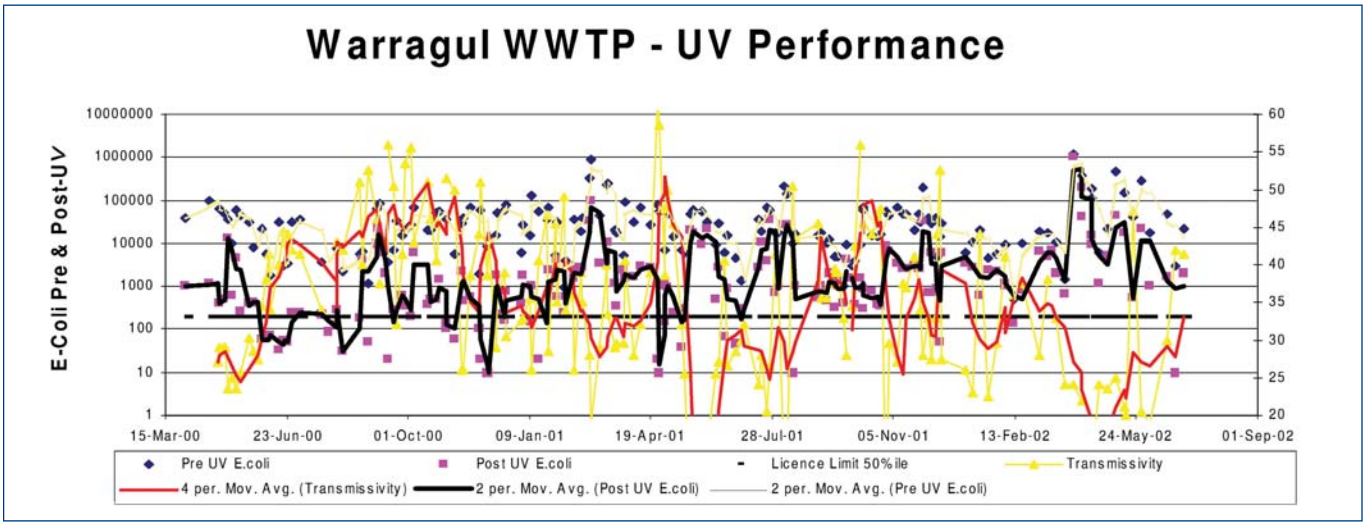

Figure 1. Performance of the UV disinfection system at the Warragul WWTP. The black line shows the post UV *E. coli* count and the red line the transmissivity.

The Warragul WWTP situated in Gippsland (Victoria, Australia) was commissioned with a UV disinfection system. After repeated failures to meet the coliform requirements in the final effluent, the contractors agreed to replace the existing system with an alternative system.

The new UV system was designed to produce an effluent median coliform count of 200 orgs/mL from an effluent with a minimum transmissivity of 20% at a flow of 150 L/sec.

This system also failed to consistently meet the specified requirements. Although the plant produces an effluent with poor transmissivity, it has usually been better than the 20% minimum required. There has been a progressive deterioration in disinfection performance (Figure 1) which has not been improved by the installation of new UV lamps. This deterioration in performance may be associated with a progressive deterioration in effluent transmissivity (Figure 1).

The Warragul WWTP receives influent from a normal domestic catchment with three identifiable trade wastes which may contribute to the poor transmissivity of the final effluent. These wastes derive from a cattle saleyard, a photographic waste processing business and a water treatment plant.

The Approach

The **s:can Spectrolyser** has been recently introduced to Australia and New Zealand and offers an opportunity to uniquely investigate the problem. The unit has been used to:

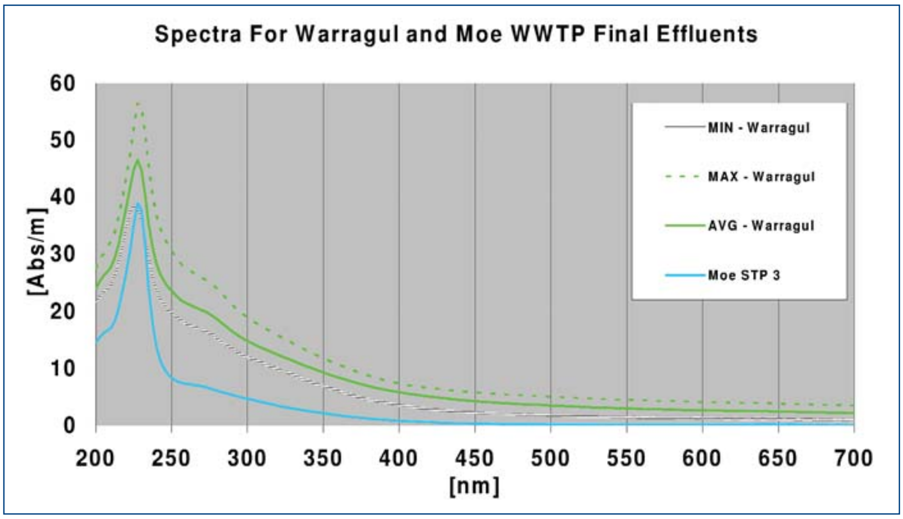

Figure 2. Comparison of absorbance spectra for the Warragul WWTP and Moe WWTP.

• Record absorbance spectra of the final effluent over an extended period.

• Record absorbance spectra of the final effluent from a similar WWTP without the same poor transmissivity effluent for comparison.

• Record absorbance spectra of the individual wastes streams (saleyard, photographic waste and alum sludge) and compare these spectra with that of the final effluent.

The Outcome

Figure 2 shows absorbance spectra for the Warragul WWTP and the Moe WWTP final effluents. The Moe WWTP is free from the problems experienced at the Warragul WWTP.

The figure clearly shows the increased UV absorbance of the Warragul WWTP effluent.

Analysis of the individual absorption spectra suggests that all three trade waste streams could affect the performance of the UV disinfection system.

The s:can Spectrolyser was luckily installed at the same time that the photographic waste processing business was closed down for maintenance. The plant started up approximately 2 weeks later. Figure 3 shows the absorbance at 254 nm along with flows from both the photographic waste processing business and the cattle saleyard. Recording of cattle saleyard flows only commenced at the same time however the flows shown in the figure are representative for the entire period of the graph.

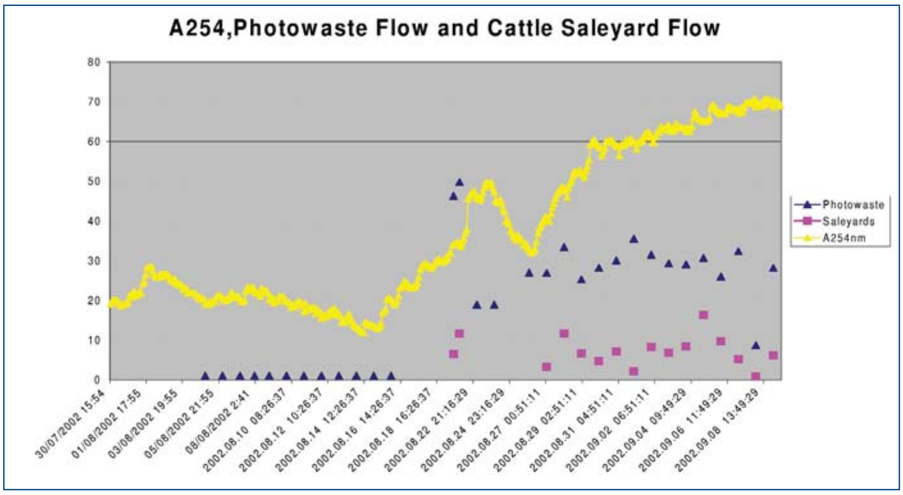

Figure 3. Correlation of UV absorbance with the resumption of flows from the photographic waste company. (Cattle saleyard flows were consistent throughout the period. Daily recording only commenced as shown in the figure.)

The figure clearly shows the correlation between the deterioration of effluent quality and the resumption of business by the photographic waste processing company.

The instrument is available from DCM Process Control (ausoffice@dcmprocesscontrol.com).

The Author

Peter Mosse (peter.mosse@gippswater.com.au) is currently working as an internal consultant in Water and Wastewater Treatment for Gippsland Water and other clients.

REMOVING ALGAL TASTES AND ODOURS FROM DRINKING WATER

Gayle Newcombe and David Cook

Geosmin and 2-methylisoborneol (MIB) are earthy – musty odour compounds that regularly cause problems in domestic water supplies in Australia. Problems associated with these compounds are on the increase because of increased nutrient levels in our raw water sources leading to increased numbers of algae in the water.

Powdered activated carbon (PAC) can be a cost-effective way of removing offensive tastes and odours from drinking water. PAC is porous, like a solid sponge, with a very large internal surface area. Contaminants in the water, like MIB and geosmin, stick (adsorb) to the internal surfaces of the PAC and are thereby removed from the water.

Many types of PAC are available on the market. To obtain the most effective and efficient treatment, water treatment plant staff should choose the appropriate type of carbon for their water, use the correct dose of PAC, and consider the various factors that influence PAC dose. Over the past five years, the Australian Water Quality Centre (AWQC) has run a series of tests using different types of PAC and different doses to help establish these parameters.

PAC can be manufactured from wood or coconut shells and may be steam or chemically activated.

Blue-green algal blooms (or cyanobacterial blooms) are becoming more prevalent in our raw water sources as water quality decreases due to higher nutrient input and the effects of global warming.

Choosing the Right PAC and the Correct Dose

Four activated carbons were tested for MIB removal in water from Myponga Reservoir in Adelaide. The starting concentration of MIB in each case was 100 ng/L. The four carbons tested were:

- C1 – a steam activated wood PAC.
- C2 – a steam activated coconut PAC, with a high level of activation.
- C3 – a chemically activated wood PAC.
- C4 – a steam activated coconut PAC, with a low level of activation.

The results are shown in Figure 1.

The results in Figure 1 show that the most efficient activated carbon for the removal of MIB in a Water Treatment Plant (WTP) will depend strongly on the contact time available for adsorption. Contact time is the time that the water and PAC are mixed together before the PAC is removed. For example C1 and C3 show similar removal after short contact times (< 20 mins) but at longer contact times, C1 is superior.

The choice of an activated carbon depends on both the cost and performance. In Table 1, the costs associated with using the four carbons are given. The calculations were based the carbon dose needed to achieve 50 percent removal of MIB (e.g., from 20 ngL^{-1} to 10 ngL^{-1}) at a flow of 50ML per day, over a period of 10 days.

Although the cost of dosing with C1 is higher than that for C2, the advantage

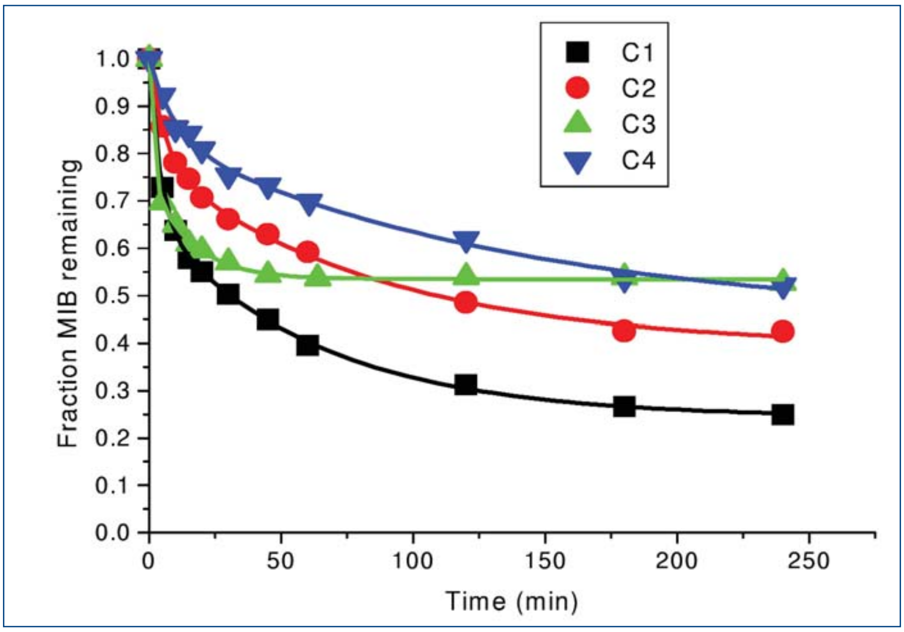

Figure 1. Fraction of MIB remaining after different contact times for the four activated carbons.

of handling and storing smaller amounts of C1 may be more important for some water suppliers. C3 is relatively effective at short contact times (Figure 1), but it would probably not be used for taste and odour removal because of the high costs involved. As a low-activation coconut-based product, C4 is less expensive per ton than the high-activation coconut carbon, C2; however, there is no cost benefit associated with the use of C4, as the doses required are higher. The use of similar dose predictions can allow authorities to weigh the advantages and disadvantages and make informed decisions regarding PAC application.

PAC dose predictions can also be used to determine when PAC application would no longer be cost effective and other, more advanced techniques should be considered. Figure 2 shows cost estimates for dosing a high-activation coconut carbon (C2) for MIB or geosmin for a prolonged period at one Adelaide WTP when the target concentration of the compound is 10 ng/L. For example, for an inlet concentration of 20 ng/L present over two weeks, dosing of PAC would cost around $2,500 for geosmin, and $5,000 for MIB. On the other hand, if an inlet concentration of 50 ng/L was present for a month, the cost would be $12,000 and $27,000 respectively.

The difficulty of removing MIB, compared with geosmin, is reflected in the higher cost of PAC dosing for MIB. If high concentrations of MIB were expected for several months each year, the water authority could make a decision regarding other treatment options based on this type of analysis.

PAC particle size also plays an important role in the adsorption of MIB and geosmin. Figure 3 shows the cost benefit associated with a particle size of 10 microns (μm) compared with 23 μ, as a function of geosmin inlet concentration (dosing in a 50 ML/d plant over 10 days), target concentration, 10 ngL^{-1}. For an inlet concentration of 50 ngL^{-1} a cost saving of $3,500 could be gained over 10 days by using the smaller particle size.

Clearly there is a particle size limit below which ease of handling of the PAC becomes an issue. A very small particle size may also result in removal difficulties using conventional methods, and possible breakthrough into the distribution system and associated dirty water complaints. The 10 μm median particle size has proven to be optimum for the WTP's supplying Adelaide, using both conventional and dissolved air flotation technology.

Table 1. PAC costs, and doses required to reduce MIB from 20 to 10 ngL^{-1} for four activated carbons at a 50 ML per day flow for 10 days. Myponga Reservoir water.

	C1	C2	C3	C4
PAC dose (mgL-1)	16	31	26	38
PAC required for 10 days dosing (tonne)	8.0	15.5	13.0	19.0
Cost for 10 days dosing (AUS$)	**28 000**	**24 800**	**41 600**	**28 500**

Recommendations at a Glance:

Step 1. Choose the right PAC, then determine appropriate doses for your WTP.

1. Test a range of PACs, under conditions related to the individual treatment plant.
2. Use computer aids to determine the doses you need.
3. Weigh up the advantages of lower dose against higher cost.
4. Decide whether an alternative treatment (such as GAC) would be more cost effective over prolonged T & O episodes.

When Will You Need to Change PAC Doses?

Once the appropriate PAC doses have been determined for a particular water source, the question to be answered is: How will changes in raw water quality and treatment processes affect PAC doses?

Alkalinity, hardness, and pH do not appear to affect the adsorption of MIB and geosmin over the ranges generally encountered in drinking water treatment. Therefore changes to these water quality parameters will not affect the PAC doses required for taste and odour removal.

In contrast, dissolved organic carbon (DOC) concentration and character both strongly affect the adsorption of MIB. As a general rule, an increase in DOC concentration will result in an increased PAC dose requirement for MIB removal.

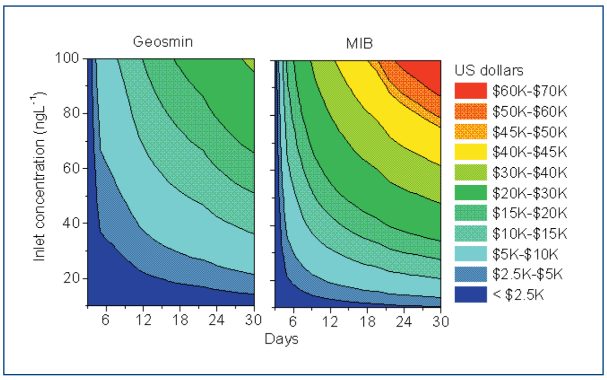

Figure 2. Cost estimates for prolonged PAC dosing

In contrast geosmin removal, and therefore PAC doses, are not strongly affected by DOC. To date, no clear relationship has been identified between DOC concentration and PAC doses for MIB removal. Research into this aspect is continuing, with the aim of producing a "DOC factor", which can be used to modify PAC dose predictions for MIB.

Some water treatment processes also affect the removal of taste and odour compounds using PAC. The presence of a chlorine residual has been shown to reduce the removal of both MIB and geosmin by PAC.

It has been reported that the application of PAC at the point of addition of alum or other coagulants reduces the adsorption efficiency. The adsorption of MIB and geosmin are not affected by high turbidity levels alone. However, in a jar test where the PAC was added during alum flocculation, the turbidity of the water had a significant effect on the alum dose and the removal of geosmin and MIB.

This reduction of removal efficiency is attributed to the binding of the PAC in the floc. The effective contact between the water and the PAC will depend on the size and density of the resultant floc; for example, more efficient contact could be expected from a small floc with loosely bound particles than from a large, dense floc. The size and structure of the floc will depend on turbidity, DOC, and alum dose.

Recommendations at a Glance

Step 2. Know how PAC doses may change with the situation.

1. If the DOC/UV absorbance increases, it has no effect on the PAC dose for geosmin, but the PAC dose for MIB should increase.
2. If turbidity increases, then PAC dose applied 30 minutes prior to coagulation will remain the same; but if the PAC is applied simultaneously with an increased coagulant dose, it will decrease the removal effectiveness for both MIB and geosmin, and the PAC dose required will increase.

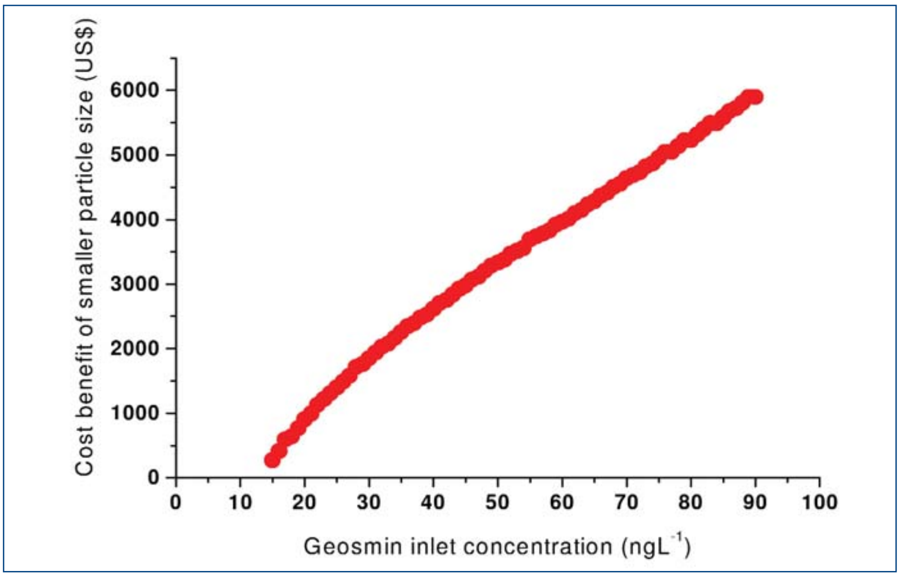

Figure 3. Cost advantage associated with the smaller particle size (10 days dosing, 50ML/d flow)

3. If there is a chlorine residual present after prechlorination, then PAC dosage for geosmin and MIB should be increased; if there is no chlorine residual present, prechlorination will have no effect on PAC dose.

Action Plan for Effective PAC Treatment

When musty-earthy odours occur regularly in a water supply, consumers may not only turn to other drinking water options (bottled water, point of use filters) but may also begin to lose confidence that their water is safe to drink. At the same time, the water supplier, when applying activated carbon for the treatment of the problem, would like to be sure that the money is well spent.

The aim should be the reduction of these compounds to below 10 ng/L, or, if possible, below 5 ng/L, to minimize the number of consumers able to discern the musty - earthy odours. In many cases, the answer is the optimization of the application of PAC. Steps for such an optimization program should entail:

1. Communication with PAC suppliers to ascertain price and availability. Tell your dealer the carbons should be microporous, with a low percentage of oxygen by elemental analysis (the manufacturers will have that information).

2. Testing at least four carbons for the removal of your problem compound(s) - a conventional jar test should be effective, but add only PAC, no coagulant - over the contact times available in your treatment plant, and over the range of MIB and geosmin concentrations expected. Keep in mind the effective contact time in your plant will be only during the time when the carbon is in suspension (as particles, or in a floc), very little removal occurs during the sedimentation stage of treatment. If the amount of PAC used at your treatment plant is a problem in terms of storage or dosing facilities, be sure to test a couple of the more expensive, higher activation level carbons.

A rough estimate of the doses required for your situation will then be possible. Choose the most appropriate carbon. (Do you want moderate cost and doses? Or high cost per ton, but low dose requirements?) A more detailed analysis of dose requirements and associated costs can then be carried out if required.

The Australian Water Quality Centre is available to help determine the best PAC and the most appropriate doses.

The Authors

Gayle Newcombe is a senior research scientist for the Australian Water Quality Centre, a partner in the CRC for Water Quality and Treatment, PMB 3, Salisbury, South Australia 5108, Australia. Contact her at gayle.newcombe@sawater.com.au. **David Cook** is a research officer working on the removal of tastes and odours and algal toxins using activated carbon, also at the AWQC.

'IT'S ALWAYS ON A FRIDAY'

Ken Turner, Gippsland Water

It is late Friday afternoon. You have had a good week in the field, things have been achieved without any major "stuffups" happening, when the screech comes over the two-way radio, "can you attend a customer complaint for chlorine taste and odour?"

Pulling up outside you feel pretty confident that the retic system has been running fairly well and you should be able to deal with this easily and start thinking about the weekend.

A rap on the door, the door opens and a beautiful Indian lady appears, just when you are about to introduce yourself a feeling of horror comes over you, the company badge on your chest seems to double in size, and the vehicle seems to glow in the failing winter light as you notice she has green hair. Squirming on the spot she notices your discomfort and explains to you that she has just been to a fete at the kindergarten, hence the hair colour.

Feeling a little bit easier you are just about to inquire about her problem when two white kids run to the door to see who is there. That discomfort reappears and the chills run down the spine and the hazard light on the car seems twice as bright "Oh no, I have bleached the kids."

The lady not realizing your anguish introduces you to the neighbours children she is looking after. You are still feeling a little tense and the hackles on the back of your neck are still upright when she explains to you that she has noticed a chlorine smell in the water the last two mornings. This scenario is feeling a little more familiar to you and the heart palpitations are starting to ease when you quickly scan the brains for any events over the past week. You realize that there had been a burst main just around the corner and perhaps the flushing after clean-up was not adequate.

So a quick flush, a chlorine residual check, and a reassurance to the lady to please ring again if the problem still exists, you head off home not yet calm, but knowing you have done the best you can and it's only just dark. Now for some tea, a warm fire, a beer or two and Friday night football.

The Author

Ken Turner (ken.turner@gippswater.com.au) is a Disinfection Technical Officer at Gippsland Water.

RUSSELL'S BRAIN TEASER

A Water Treatment Plant has a heavy rainfall event in its catchment, resulting in higher raw water turbidity and colour levels. After carrying out jar tests, it is determined that the jar that had 3.5mls of the 1% alum jar test solution added to it gave the best results.

Current Plant Conditions

Plant Flow Rate	= 11 l/s
Current Alum Feed Rate	= 20 mls/min
Turbidity	= 65 NTU
True Colour	= 90 Haz

With the information provided answer the following questions.

Q1. What is the optimum alum dose rate in ppm/v ?

Q2. Calculate the current alum dose rate in ppm/v?

Q3. What will the alum feed rate (in mls/min) be for the new dose rate ?

Q4. What would the optimum alum dose rate be if the Plant flow rate was increased to 22 l/s ?

Q5. What is the alum feed rate for the above flow ?

Q6. On establishing the new dosing conditions the turbidity of the product water from the plant is <1NTU, however the colour is 12 Haz. Describe the steps you would take to reduce the colour as well.

ANSWER TO "NEERIM NUMBERS" BRAIN TEASER 2

The growth rate of the biomass could either be determined from a graph or by simply subtracting the MLSS on 23/7 from the MLSS on the 10/9.

2320 mg/L - 1500 mg/L = 820 mg/L.

This growth has occurred over a period of 49 days (23/7 to 10/9), so the daily growth is 820 mg/L / 49 days = 16.7 mg/L/d.

Therefore to maintain a constant MLSS 16.7 mg/L/d needs to be wasted

Since the reactor volume is 375m3 (375,000L) the total biomass needed to be wasted is,

16.7 mg/L x 375,000 L = 6,265,500 mg/d
= 6.3 kg/d

Assuming the reactor MLSS is 2000 mg/L the volume that needs to be wasted from the completely mixed reactor is,

6,265,500 mg/d / 2000 mg/L = 3131 L/d.

Since the wasting pump rate is 5.1 L/sec the pump needs to pump for,

3131 L/d / 5.1 L/sec = 614 sec/d
= 10 mins/d.

Since there are 6 cycles each day the WAS pump needs to run

10 / 6 mins/cycle = ***1.7 mins/cycle***

2002 CONFERENCE REPORT

The 65th Annual Victoria Water Industry Engineers and Operators conference was staged in Geelong in early September 2002. The conference was hosted by Barwon Water, who also took on the role of major sponsor.

A highlight of the conference was the launch of the updated national Water Industry Training Package by current AWA Federal President Mr Barry Norman. A number of invited dignitaries representing the key training bodies who worked on the upgrade of the package content were in attendance. The original founders of the Victorian operators association were instrumental in developing training programs for operators around 30 years ago. Their successors, the Water Industry Operators Association, are very pleased to have been able to continue this link with training through the launch of this important industry initiative at out event.

The conference this year attracted well over 300 delegates and visitors as well as more than 100 representatives from the various trade organisations who participated in the trade exhibition. The trade exhibition was fully booked (59 trade sites) around three weeks before the event and unfortunately a number of companies missed out on exhibiting. Thanks to all these companies and our other conference sponsors.

In all there were 19 technical papers presented on a wide variety of topics. In addition there were 8 operator poster papers presented. The award winners this year included:

Hepburn Prize for Best Paper Overall – ***Anthony Evans*** – South West Water

Actizyme Prize – Best Paper by WIOA Member – ***Anthony Evans*** – South West Water

Actizyme Prize 2nd Place – ***David Reyne*** – Central Highlands Water

Actizyme Prize 3rd/Encouragement – ***Jeff Roscoe*** – North East Water

Water Industry Training Centre (WITC) Prize – Best Operator Poster Paper – ***Len Ablett*** – Gippsland Water Authority.

WITC Prize 2nd Place – ***Wayne Mumford*** – Gippsland Water

WITC Prize 3rd Place – ***Wayne Reither*** – Goulburn Valley Water

The winners in both categories above all won generous cash awards from the sponsors.

AWA – "Victorian Operator of the Year Award" – ***Paul Keating*** from Gippsland Water.

We look forward to seeing everyone at the 66th Annual Conference in the first week of September 2003.

George Wall
WIOA Secretary

Paul Keating - AWA Operator of the Year 2002

John Park,
AWA (Vic) Committee Member

Victorian Operator of the Year, Paul Keating, receives his award from AWA Victorian President, Peter Robinson.

Gippsland Water operator, Paul Keating, was awarded the Wal Whiteside Victorian Operator of the Year Award at the recent Annual Victorian Water Industry Engineers and Operators Conference held in Geelong.

The 280 conference registrants hailed Paul's achievement warmly at the conference dinner where he received the perpetual shield from AWA Victorian Branch President, Peter Robinson.

This award was first presented at the 1980 Conference and it represents the pinnacle in achievement by Victorian Water Industry Operators. The list of former recipients boasts many of the industry's most capable treatment plant operators. The award is highly respected throughout the industry. It commemorates Wal Whiteside who, as Chairman of the Geelong and District Water Board was a staunch supporter of operators and their opportunity to participate in the Conference.

Paul was nominated by Gippsland Water and beat an excellent field of very competent operators nominated by their employers. The esteem in which these personnel are held by their organisations is to be commended and certainly confirms the standing of this award in the industry. Paul's nomination certainly reflects that esteem.

Paul is a Senior Wastewater Treatment Plant Operator with 12 years of experience with Gippsland Water. He currently has sole operational responsibility for the Moe and Willow Grove Wastewater Treatment Plants. Moe is a state of the art IDEA plant and Paul has actively contributed to the implementation of major plant upgrades and detailed research into projects such as the potential for enhanced biological phosphorous removal at the plant.

He is a willing and capable operator who has completed extensive wastewater operator training during this time with excellent results. His skills extend to the operation of complex on-line instrumentation which have enabled him to optimise treatment processes. This knowledge has been used by him to present two papers on the process upgrades at Moe WWTP, including one presented at the WIOA Conference in Geelong.

Paul is an unassuming team member who has complete interest in his work and the improved performance of wastewater treatment and a very worthy recipient of this prestigious award.