BENEFICIAL ODOUR CONTROL IN SEWERAGE SYSTEMS

Paper Presented by:

Graeme Watkins

Author:

Graeme Watkins, *Manager Strategic Operations,*

MidCoast Water

7th Annual WIOA NSW Water Industry Operations Conference and Exhibition
Exhibition Park in Canberra (EPIC),
9 to 11 April, 2013

BENEFICIAL ODOUR CONTROL IN SEWERAGE SYSTEMS

Graeme Watkins, *Manager Strategic Operations,* MidCoast Water

ABSTRACT

MidCoast Water has used magnesium hydroxide to effectively control hydrogen sulphide odours in small sewage pump stations. The use of magnesium hydroxide has reduced our operating costs by removing the need to use potable water and ineffective chemicals, whilst reducing odour issues, internal sewer corrosion and improved confined space space entry as high levels of hydrogen sulphide are no longer present.

MidCoast Water developed a trial of magnesium hydroxide as a control method for hydrogen sulphide. A number of trial installations were established at sewage pump stations with known odour issues. A relatively small dose of 40 mg/L of magnesium hydroxide was able to reduce hydrogen sulphide levels from over 100 parts per million (ppm) to less than 5 ppm by using a small and inexpensive dosing system.

The use of magnesium hydroxide has significantly reduced our operating costs by removing the need for potable water use to reduce septicity and the need for other chemical or biological agents to mask or control odours.

1.0 INTRODUCTION

MidCoast Water (MCW) provides sewerage services to a number of small towns and villages on the mid north coast of NSW ranging in size from 2,000 to 20,000 persons over an area of 8,000 km^2. The density of connections per length of main is typically much higher than larger urban centres. MCW has about 35,000 sewer customers and serves these customers with over 250 sewage pump stations.

On top of this, most sewage pump stations (SPS) operate at about 1 to 1.5 hours per day in non peak periods on the coast due to design for peak holiday loadings and inland due to peak wet weather flows being twice that of normal design values.

As a consequence there are a number of sewage pump stations (SPS) with septicity issues, causing odour complaints, safety issues with confined space entry for workers and concrete and metal attack.

Previously we had used potable water to reduce septicity, but this was unsustainable, a waste of a valuable resource, increases in power usage and costs to pump and treat the additional water. We also used a ferric sulphate chemical dosing system at a small number of sites and this proved to be ineffectual and was hazardous to handle.

MidCoast Water examined the life cycle costs and effectiveness of chemical treatments and magnesium hydroxide (MgOH correct formula is $Mg(OH_2)$) had the best attributes. MgOH works by maintaining pH above 7 and preventing hydrogen sulphide (H_2S) from forming by keeping the dissolved sulphides in solution. MgOH is not a dangerous good but is a heavy slurry that will thicken if settled or if moisture content varries outside of 50 to 58 percent solids.

MCW developed a trial of MgOH as a control method for hydrogen sulphide (H_2S). A number of trial installations were established at sewage pump stations with known odour issues.

2.0 THE TRIAL

MCW examined the current sites it operated with odour control systems and their effectiveness. Odours were regularly reported by our customers and field staff at these sites. So it was decided to undertake the trial at these sites to allow reference back to existing systems and measure changes relative to these current odour control methods.

The first trial was undertaken on a sewage pump station (SPS) south of Taree serving the small village of Tinonee approximately 6 km from the SPS where the trial was undertaken. The SPS is named Ti4. Average dry weather flow through the SPS is 250 kL/day with a rising main length of 0.9 km and average detension time of 4 hours, however upstream detention exceeds 16 hours of additional pressure main. This site used ferric sulphate to control odour. The cost of ferric sulphate is slightly more than that of MgOH and ferric sulphate is a dangerous good for handling.

The other site trialed was at Pacific Palms with the village sewerage system consisting of six cascading SPS's. This area is a coastal holiday area and non peak periods can see a significant reduction in flows. The SPS is named PP4. Average dry weather flow through the SPS is 160 kL/day with a rising main length of 1.2 km and average detention time of 6 hours, however upstream detention exceeds 16 hours of additional pressure main at non peak periods. This site used potable water to control odour, the costs of water (22 ML/year upstream of SPS PP4 and for the entire Pacific Palms system 66 ML/year) through the sewerage system was valued at $55k/year ($165k for the entire Pacific Palms system) and incurred $1.2k/year ($10k for the entire Pacific Palms system) in additional electricity costs for pumping.

Our aim was to simplify the trial and the civil works needed, to do this typically we decantered the 1000 litre intermediate bulk container (IBC) into a 200 litre drum. This provided chemical storage for approximately 3 to 4 weeks at the dose rates provided. The drum was sealed to maintain moisture content in the MgOH and a mechanical mixer was not needed as storage was short. A peristaltic pump was used to inject the MgOH into the wet well on the basis of every time the pump came on a predetermined run time (30 to 40 seconds) of the peristaltic pump was set to obtain the desired MgOH concentration in the sewage to control H_2S formation. The injection point was as short and direct as possible to the wet well inlet to maximise mixing and prevent settling. A typical installation in shown in figure 1.

The aim of the trial was to compare existing odour control methods with various dosing rates of MgOH and determine the effectiveness of MgOH. Monitoring H_2S and sewage pH levels downstream of the rising main was the method used to determine the impacts.

Figure 1: ***Typical MgOH installation at Sewage Pump Station***

Each installation consisted of a standalone precast concrete pit to contain the 200 litre chemical drum, pump and connection to power and SPS control for timed dosing. The installation costs are about $7k per site and can be easily relocated to another SPS site if required. MgOH costs are about $4k/year for each site.

2.1 Results for various monitoring periods

Results of monitoring at SPS Ti4 (Taree)

Figure 2 shows the monitoring results for a month period at Ti4, sampling was at 1 minute frequency and a 60 point or 1 hour moving average added to take the noise out of the sample values. H_2S and pH were measured.

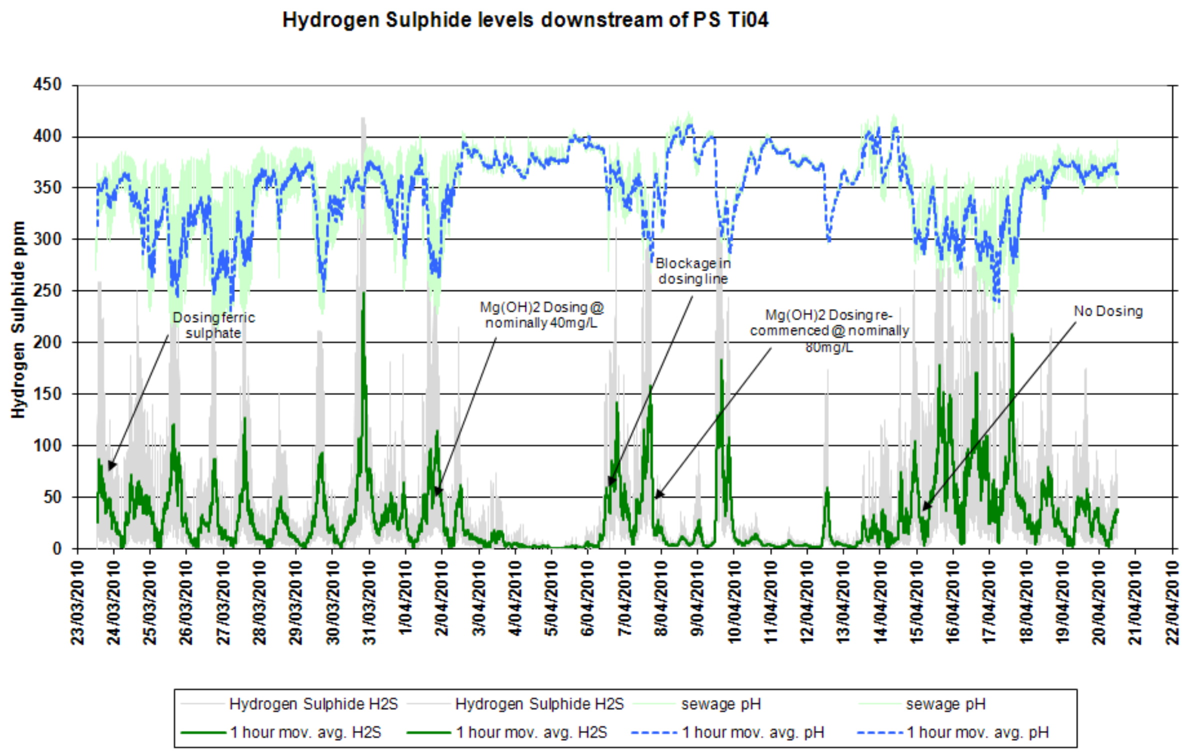

Figure 2: ***Hydrogen Sulphide levels downstream of PS Ti4***

The trial started with ferric sulphate dosing, which was the product used at the site for the previous 15 years. H_2S ranged on an hourly basis from low levels to 100 + ppm while pH was between 5 and 6.5.

MgOH commenced on 2 April 2010 and consistently reduced H_2S levels to below 5 ppm while increasing pH to over 7.5. Some blockages were initially experienced but we improved installations to shorten the dosing line and directly dose at SPS inlet line to reduce MgOH settling.

From 8 April the MgOH dose rate was doubled with no alteration in H_2S but an increase in pH closer to 8.0. All chemical dosing was stopped on 14 April 2010, H_2S was higher than when dosing with ferric sulphate and the highest recorded during the monitoring period, as expected. While pH was low it was slightly higher than when dosing with ferric sulphate. Ferric sulpate is an acid and will lower the sewage pH.

Results of monitoring at SPS PP4 (Pacific Palms)

Figure 3 shows the monitoring results for a 3 month period at PP4, sampling was at 1 minute frequency and a 60 point or 1 hour moving average added to take the noise out of the sample values. H_2S and pH were measured.

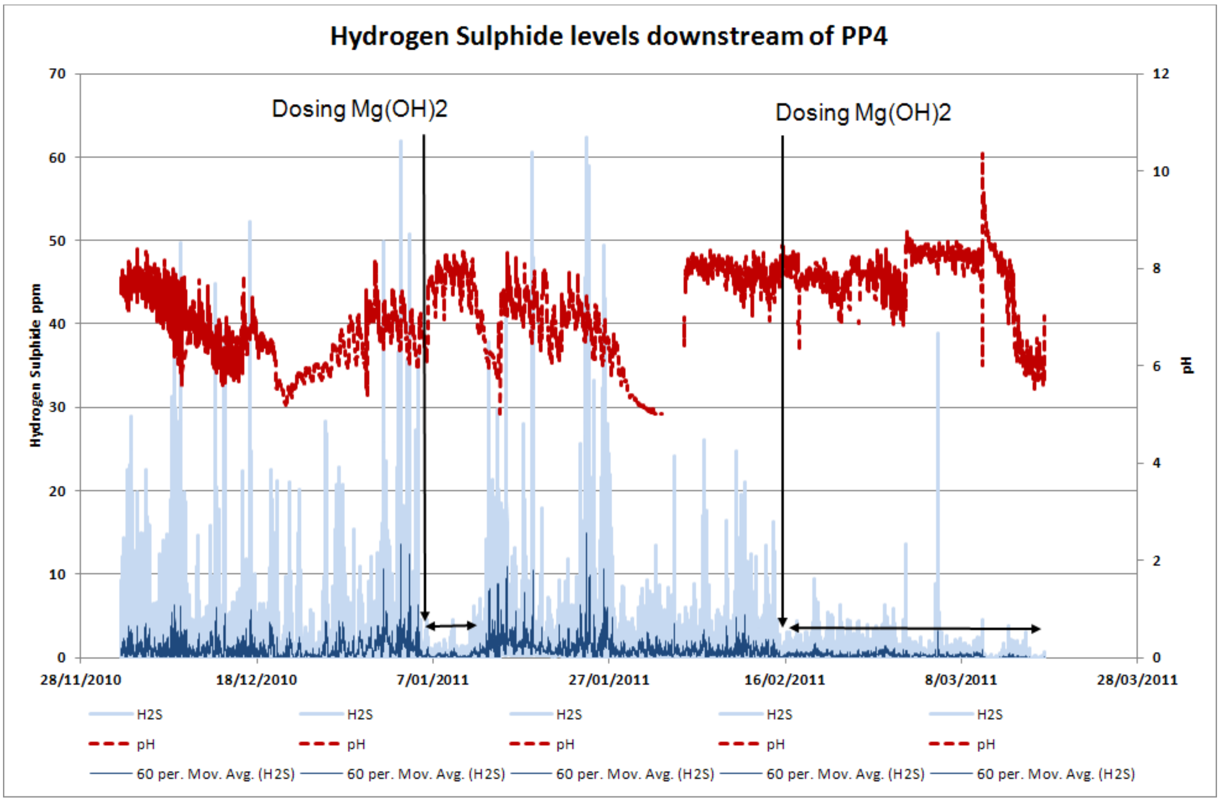

Figure 3: ***Hydrogen Sulphide levels downstream of PS PP4***

The trial started with water dosing and as a result pH was near 7 to 7.5, the pH on this site tended to drift low due to instrument issues. H_2S ranged on an hourly basis from low levels to 10 + ppm.

MgOH commenced early January 2011 for about a week and consistently lowered the H_2S to below 2ppm and increased the pH to 7.5 to 8.0 while water dosing continued.

Dosing recommenced on 15 February 2011 with the water dosing turned off and reliably produced low levels of H_2S.

Monitoring further downstream in the Pacific Palms cascading sewage pump stations demonstrated maintenance of the low levels of H_2S.

3.0 CONCLUSION

H_2S gas levels are reduced by the dosing of MgOH and has provided financial benefits and water efficiency by removing potable water use and providing an effective alternative to ferric sulpate.

The reduction of H_2S levels in the sewerage system makes the confined space entry a little safer by removing high levels of this gas and this reduction reduces the attack of concrete manholes and steel vents. Our odour complaints from nearby neighbours has also reduced.

To totally remove H_2S, MgOH in combination with activated carbon filters on the SPS vent stack can remove all traces of H_2S. The MgOH extends the life of the activated carbon by reducing the high concentrations to low levels on the carbon filter.

Installing mixers in the 200 litre MgOH container is an option to reduce settling and MgOH slurry blocking dosing lines but for our small sites it has not been utilised at this point in time.

Magnesium also provides other benefits in sewage, especially for effluent reuse, which is undertaken at Taree. Magnesium and calcium provide the counter to sodium in the effluents sodium absorption ration (SAR). Increasing magnesium and calcium can lower the SAR, a lower SAR improves plant growth rates, soil structure and stability (Hydrosciene 2012).

MCW's operational costs in power, chemicals and potale water have decreased and we are more water efficient and have found an effective alternative to ferric sulphate.

4.0 ACKNOWLEDGEMENTS

I would like to thank MCW technical staff and field staff who assisted in making the trial a reality including Chenxi Zeng, Randall Carey and Terry Pocock.

5.0 REFERENCES

Hydroscience. *TareeRecycled Water Scheme Annual Environmental Management Report 2011/12* (2012)