ESTABLISHING WATER QUALITY IN NEW DISTRIBUTION SYSTEMS OR AFTER MAINTENANCE

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ABSTRACT

This paper arose from attending a WIOA workshop on improving water quality within the distribution system and how as senior distribution staff we could be more effective in what the field staff do to maintain water quality without having to undertake formal education.

1.0 INTRODUCTION

After attending the Water Quality in the Distribution System workshop, a number of Riverina Water staff got together and started to look at ways to go about raising the standard of the water quality which was being delivered to our newly connected customers.

Up to this point of time within the field staff area of responsibilities it was always considered the Water Filtration Plant Operators duties to ensure that water leaving the treatment plants met the Water Quality Guidelines. The distribution staff duties was to connect mains and services with minimum disruptions to existing customers, fix breaks, give the mains a flush and get the water back to the consumer as quickly as possible. If it was a bit dirty, tell the customer to give us a call in a day or so and we will come and flush the area again. No water quality or health related issues were ever mentioned.

2.0 DISCUSSION

Following the initial discussions, a number of attempts where made to come up with a simple way for us to be able to sterilize the distribution system.

A number of different systems where discussed with various staff members from engineering, fitters and electricians through to field staff. The different methods discussed included Gas Chlorination and Hypo chlorination.

Gas chlorination was quickly ruled out as we had tried using gas for various portable options a few years ago and it required trained staff. There was also the issue of the bulky nature of the equipment and the dangers in transporting and handling the chlorine gas in close proximity to the general public.

This left us with using Hypo Chlorine.

The group started to discuss how we could easily induce the hypo chlorine into the system addressing safety concerns for the operator and the consumers being at the front of our mind, also the disposal of the highly chlorinated water. Also under discussion was what water quality parameters should we be checking for and how do we measure them.

The easy part of the exercise was to determine what water quality parameters should we be looking at in the field and the parameters we decided on are:

- measure total and free chlorine and turbidity
- take a sample in a sampling bottle and return it to the lab for bacterial testing ASAP.

The above measures required minimum training of the field staff and they have been happy to carryout this testing.

The next part of the exercise took some time in coming up with solutions on how to inject the Hypo into a pressurised main and a new main being charged for the first time.

This required us to get our fitters and electricians involved. After some discussion with them and consulting with the field staff as all good water supplies have many bits and pieces, old dosing pumps, water meters, plastic storage tanks laying around there workshop, portable generators etc.

Safety had a high priority in that the unit had to be easily transported and lifted easily by two staff members. The unit had to be rugged as it was to be carried on the back of trucks, trailers and on tracks following pipe line construction. There needed to be minimum dangers of splashing or leaking during transport or while on site and any problems with the dosing pump had to be easily rectified by the field staff again with minimum training. This had to be as simple as a phone call to a fitter as what to do if a fault occurs on the display panel of the dosing pump.

A couple of trial units where made and modified and over and over again before a working unit could be demonstrated to the field staff.

One of the prototypes is shown below in Figure 1. The tank was to large, we used a mechanical meter, it did not have a drop tube for measuring the quantity of chemical but overall it gave us a lot of good results to build on. This particular unit has had many different uses since its construction and is used today in different trial applications.

Figure 1: ***Prototype hypo dosing unit***

From the Prototype we continued to develop this thinking making improvements.

Some of the improvements have seen us now using an inverter to power the unit, Magflow metering, a drop tube for measuring of volume, the dosing pump has a no flow control to shut the meter pump down and audible alarm.

The Mag-Flow is connected to the dosing pump which is flow paced. The rate of flow through the Mag-Flow is manually varied by the field operator to suit the local requirements but does not have to adjust the dosing pump. Again if the field staffs have any problems it is a quick phone call for assistance.

Figure 2: ***The current dosing unit***

After reaching this point and trialling the unit a number of times it was found that we had to develop a number of charts to assist the field staff to work out the volume of water, time to charge the section of main in question and volume of Hypo required.

Another problem which arose was where existing valves and hydrants are located and how do you charge a section with highly chlorinated water and existing consumers.

The location of new hydrants and valves are now looked at more critically for future operational and ease to maintain water quality with minimum disruption to existing consumers and avoid the need to run lengths of hose across roads or the need to set up temporary services. This quiet often means we position a hydrant either side of a stop valve. This has become our standard practice when constructing sections of rising mains or long rural mains as it makes it a lot easier to charge and use the above unit to assist in maintaining the water quality

3.0 CONCLUSION

Outcomes have been that the field staff are now able to easily undertake a job which they would not have considered was their responsibility a couple of years ago.

Riverina Water has changed emphases to "the water does not go back into the system unless it meets water quality guidelines" – it is not always possible to wait for the bacterial sample results to be available before we reconnect the consumers but if we have carried out the above steps of checking for chlorine and turbidity we minimise the possibilities of contaminating our system. We also check our bacterial samples to confirm our results.

Staff are coming up with minor improvements which are being incorporated into the unit or our operating procedures.
In finishing up this unit has been used successfully on a number of large diameter mains up to 20km long as well as breaks and minor distribution problems and gives people a simple way to overcome every day problems.

Flushing of mains before Hypo chlorination has not been carried out due to the drought as it would be a waste of water, however flushing is carried out as part of the dechlorination process and it continues till we meet the Australian Water Quality Guidelines.

4.0 ACKNOWLEDGEMENT

To Riverina Water staff in the Field, Maintenance Sections and Water Quality Groups who have worked on this project.

Special thanks to WIOA for putting on the workshop and producing the Water Distribution Quality Manual and Alan McIntyre from Prominent who helped with the development of the unit.

The staff have been happy to carryout the testing. This has got to be a major point when introducing new procedures and technology. If you can get the staff to be part of the change without them complaining you want us to do more for no apparent reason you are ¾ of the way to solving the problem.

5.0 APPENDIX

An example of a table that staff have developed to assist in calculating the volume of water required to fill a section of pipeline

Litres of Water per meter of diameter

Formula:-

$\pi * r * r * \text{length}$ = metres cubed. 1metre cubed = 1kilolitre or 1,000 litres

20mm dia. = 0.31 litres per metre or 314 litres per kilometre or 0.31kl per kilometre

25mm dia. = 0.49 litres per metre or 490 litres per kilometre or 0.49kl per kilometre

32mm dia. = 0.80 litres per metre or 800 litres per kilometre or 0.80kl per kilometre

40mm dia. = 1.26 litres per metre or 1,260 litres per kilometre or 1.26kl per kilometre

50mm dia. = 1.96 litres per metre or 1,960 litres per kilometre or 19.26kl per kilometre

80mm dia. = 5.03 litres per metre or 5,030 litres per kilometre or 5.03kl per kilometre

100mm dia. = 7.86 litres per metre or 7,860 litres per kilometre or 7.86kl per kilometre

150mm dia. = 17.67 litres per metre or 17,670 litres per kilometre or 17.67kl per kilometre

200mm dia. = 31.42 litres per metre or 31,420 litres per kilometre or 31.42kl per kilometre

225mm dia. = 39.77 litres per metre or 39,770 litres per kilometre or 39.77kl per kilometre

250mm dia. = 49.09 litres per metre or 49,090 litres per kilometre or 49.09kl per kilometre

300mm dia. = 70.70 litres per metre or 70,700 litres per kilometre or 70.70kl per kilometre

350mm dia. = 99.23 litres per metre or 99,230 litres per kilometre or 99.23kl per kilometre

375mm dia. = 110.47 litres per metre or 110,470 litres per kilometre or 110.47kl per kilometre

400mm dia. = 125.68 litres per metre or 125,680 litres per kilometre or 125.68kl per kilometre

450mm dia. = 159.05 litres per metre or 159,050 litres per kilometre or 159.05kl per kilometre

500mm dia. = 196.38 litres per metre or 196,380 litres per kilometre or 196.38kl per kilometre

600mm dia. = 282.78 litres per metre or 282,780 litres per kilometre or 282.78kl per kilometre

Example

20mm service 1kilometre long following at 1litre per second will take approx. 6 minutes to flush

32mm service 1kilometre long following at 1litre per second will take approx. 14 minutes to flush

100mm service 1kilometre long following at 1litre per second will take approx. 2.2 hrs to flush

100mm service 1kilometre long following at 4litre per second will take approx. 33 minutes to flush

300mm service 1kilometre long following at 10litres per second will take approx. 1.96 hrs to flush