FLUORIDATION - THE PATHWAY TO CERTIFICATION

Paper Presented by:

Kelvin Woods

Author:

Kelvin Woods, *Treatment Coordinator*,

Dalby Regional Council

33rd Annual Qld Water Industry Operations Workshop
Indoor Sports Centre, Carrara – Gold Coast
3 to 5 June, 2008

FLUORIDATION - THE PATHWAY TO CERTIFICATION

Kelvin Woods, *Treatment Coordinator*, Dalby Regional Council

1.0 INTRODUCTION

Realising that at least for now, very few of you fluoridate your water supplies, but with the advent of compulsory fluoridation, I thought that I may give you some small insight into Dalby's Fluoridation System and the pathway to achieve certification.

Fluoridation is a contentious issue and I have no personal opinion for or against, only that if we must fluoridate, lets do it right!

1.1 Fluoridation in Dalby

- Commenced fluoridation in 1967.
- Continuous operation except for the period 1993-96.
- Fluoridation plant upgraded progressively to comply with the new Code of Practice.
- Certified without conditions in 2004.
- Serves approximately 11,000 population.

The Dalby plant:-

- Uses powdered Sodium Fluoride batched with softened water into 2% solution.
- Solution is dosed into the main pump suction at a metered rate proportional to flow.
- Fluoridated water is pumped to reservoirs in town and then distributed to customers.

2.0 DISCUSSION

2.1 Options for Councils Considering Fluoridation

- Sodium Fluoride matches the design and operating "philosophy" of older smaller plants (<20ML/day) and is probably best suited to retrofits.
- Hexafluorosilicic Acid (HFA) is more suited to plants with bulk handling facilities or new plants with more sophisticated control and safety systems.

It should be noted that some of the main players involved in compulsory fluoridation are considering a one size fits all approach when it comes to what 'type' of Fluoride is used.

It is our opinion at the Dalby Plant, that Sodium Fluoride matches the design and operating "philosophy" of older, smaller plants of less than 20ML/day and is probably best suited to retrofits. Whereas, Hexafluorosilicic Acid (HFA) is more suited to plants with bulk handling facilities, or to new plants with more sophisticated controls and safety systems. There are carbon concerns in trucking a low concentration solution HFA (mostly water), all across the country.

Potential automatic bag loaders and splitters are great for dust reduction for the Operator, but is this balanced against maintenance and repairs?

Let's hope common sense prevails with the introduction of compulsory fluoridation and all options are considered.

2.2 Operational Necessities

When setting up a fluoridation system you require:-

- basic lab facilities;
- accurate dosing equipment, which includes calibration and servicing;
- safety systems including interlocks, contingency plans;
- documented systems, manuals, procedures, and sampling schedules;
- skilled staff that are committed to high standards; and
- a dedicated fluoridation room or facility.

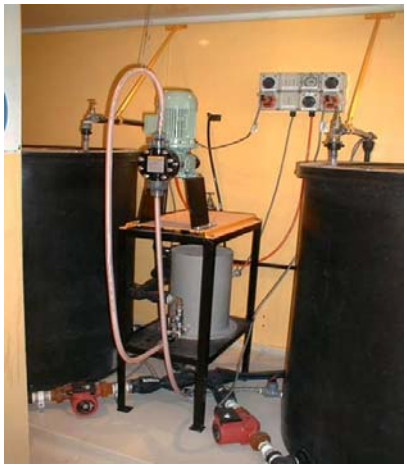

Figure 1: ***Things were upgraded***

2.3 Dalby's Laboratory

- A fixed ISE monitor with continuous logging as primary reference.
- A Merck spectrophotometer with Alzarin method as a secondary indicator.
- Formal QA system (not certified).
- Operators do all routine testing and sampling.
- QHSS perform "surveillance" testing.

Dalby's laboratory was basic, but well enough equipped. However a large capital outlay was required to purchase an on-line monitor. Our existing spectrophotometer with Alzarin method is used as a secondary indicator, as this method type is not recognized by the Code of Practice.

Dalby has a formal, although not certified Quality Assurance system and our Treatment Plants are assessed regularly.

Operators do all routine testing and sampling, including the distribution system. As the QHSS samples for their "surveillance" testing are from the same points, it is not much more work to collect and send these off for analysis.

2.4 Minimum Lab Requirements

- "Minimum" of one test per day.
- ISE portable meter or Spadns Reagent method.
- Documented calibration, sampling, operation and maintenance procedures.
- Testing and sampling schedules.
- Sampling equipment, bottles, eskies, etc.
- Testing records, log sheets etc.

Figure 2: ***Online ISE monitor - primary system***

Figure 3: ***Alzarin complexone spectrophotometer - secondary/backup system***

2.5 Dosing

- Flow proportional-linked to flow meters. Maximum dose rate at maximum flow rate is very close to desired dosage with only occasional adjustment necessary.
- Standard metering pump.
- Batch tanks hold approximately 24 hours at maximum dosage.
- Batch tanks are sized to prevent the possibility of high dosages from "accidents".
- No manual operation capability.
- Batch and dosing water is softened to below 80mg/L hardness.

Dosing pumps are flow proportional-linked to flow meters. The maximum dose rate at maximum flow rate is very close to desired dosage with only occasional adjustment necessary. A standard metering pump is used and there is no manual operation capability of the fluoride pump.

The batch tanks hold approximately 24 hours at maximum dosage and are sized to prevent the possibility of high dosages from "accidents". The batch and dosing water is softened to below 80mg/L hardness, this to assist with scale prevention in the smaller dose lines used. The dosing system works on a set of interlocks or failsafe controls and if any of these are unavailable then the fluoride must be taken offline.

We found with the implementation of Standard Operating Procedures and some simple ideas, we were able to substantially reduce the dust created to the satisfaction of the State, thereby not having to install an expensive mechanical dust removal system.

Figure 4: ***Dalby's fluoride room***

2.6 The Audit

To ensure our adherence to the Regulations and the Code of Conduct, regular audits of our fluoridation system have been carried out.

The audit team was comprehensive including:-

- Director, Oral Health Unit, Queensland Health
- Supervisor Inorganic Chemistry, Queensland Health Scientific Services
- Principal Adviser (Occupational Health & Hygiene), Workplace Health & Safety Queensland; and
- Senior Technical Officer, Water Industry Regulation, Department of Natural Resources and Water.

Although the audits are only conducted annually, the audit and their outcome have had a big impact operationally and at that time audits of this type were not familiar to our Treatment Plant Staff.

2.7 Do Not Fear the Audit

Dalby's Fluoridation Plant upgrade was one of procedures and being quite pleased with the procedures that I had already started writing; I was somewhat miffed to say the least when told they needed a Council Logo, header or footer, revision date and the like.

We were astounded that they had as much focus on a tiny missing logo as they did in fail safe systems! I can say that at the first fluoridation audit there was some locking of horns, loud exchanges and perhaps some hurt feelings as criticisms and advice were taken as a personal affront. My role back then was that of a supervisor, but also of a hands-on Operator and how dare these people "attack" my Plant and Staff.

Of course, as each audit took place I can remember getting a little confident, as one year I handled the audit on my own when all the senior staff were in Brisbane. When they rang to ask how it went? - *"All good - no problems"* was my reply. However the next day we were served with an infringement notice! I realised that communication is the key and these things were not about winning but about continuous improvement. One benefit of the audit process was to organise a morning tea, paid for by the Auditors.

This morning tea provides an informal setting, in which the group can discuss any specific areas and each member of the audit team in turn, gives a brief verbal report pertaining to their area of expertise and finally the visit is summed up by the team leader. The process, after the initial shock of a group audit situation has proven to be a beneficial one. In fact we actually began to look forward to meeting up with the team each time and to meet any new faces. Yes and the morning teas as well!

The auditors visits are now not so often, but we would happily ask them to come out and conduct a training session in fluoridation. Our approach has changed and has become for the most part, one of learning from them, knowing that they are only too happy to assist in a broader capacity when asked. Thinking back now the 'Pathway to Certification' has not just given us a certified fluoridation plant, but the entire Water Plant has benefited.

We are not a large Treatment Plant and have only one Duty Operator and an Assistant, but it has given us the platform to cope with the constant demands to "do more with less".

2.8 Safety Systems

- PPE for operators - clean shaven (another hot topic) includes long gauntlet gloves, apron and a P3 full face respirator.
- Dust minimisation procedures.
- Dedicated / segregated secure facility.
- Operator biological monitoring.
- Failsafe system design.
- Simplified system monitoring with calibrated dipsticks, standard tables and quick calculators.

We require our operators to be clean shaven for the use of the respirator. Some of our dust minimisation procedures were simply to replace the lids on the tanks and hinge them for access and to manage the way we handled the powder. Having a dedicated / segregated secure facility is imperative, with visitors to the room to be accompanied by authorised personnel.

Figure 5: ***PPE as required by Code of Practice***

Figure 6: ***Procedure review and training of operational staff***

Biological monitoring of Operators has now become routine, however it should be noted that when a rumour surfaced that all field staff were going to drug tested, well lets just say it raised a few feathers.

The health surveillance for Operators consists of a doctor's visit along with a set of pre and post shift urinary samples analysed for fluoride components only.
If you start the day with a couple of cups of strong tea, you will go to work with higher levels of fluoride in you than when you leave work.

2.9 Documented Systems

- Calibration procedures and records.
- Daily testing and chemical addition records.
- Safety equipment logs.
- Operating and maintenance procedures.
- Contingency plans.
- Training records.

Some of the documented systems may not be in the control or possession of the Water Plant Operator, but it has been found that if the Operator can verbalise the location this should suffice.

3.10 Skilled Staff

- Certificated Operators.
- In house training program.
- Period of operation under supervision.
- Competency assessment against criteria.
- Ongoing reviews.
- Event simulations.

We have certificated Operators and conduct an in-house training program. For Operators a period of fluoride plant operation is under supervision and there is a competency assessment against criteria with ongoing reviews benefiting all concerned.

Event simulations are where our team are given a potential scenario in which to work through.

3.11 Commitment to High Standards

- Council and Management support/demand for high operational standards.
- Supervisors who make quality a high priority.
- Plants should be clean and tidy.
- Operational staff are expected to be well presented.
- Commitment to investigate incidents and act on the outcomes.

Certification comes with a commitment to high standards from all concerned, Council management, supervisors and operational staff. All mentioned should make a commitment to investigate incidents and act on the outcomes.

3.12 Cost of Fluoridating

- Capex: $50,000 for dosing plant etc.
- Laboratory equipment: $30,000
- Operating Costs: $40,000 pa or 2 cents/kL
- Development of procedures, training of staff, biological monitoring etc is difficult to quantify but is largely offset by the overall improvement in professionalism.

Development of procedures, training of staff, biological monitoring, etc is difficult to quantify but is largely offset by the overall improvement in professionalism.

4.0 CONCLUSION

Dalby Operational Staff are proud of our certification.

Although now compulsory, those of you who may be embarking in the fluoridation of their Water Supply Systems in the coming years, the process itself is relatively painless and in the long term rewarding.

So as an Operator who has added fluoride for over twenty six years myself, many of the things that we were “forced” or “had to do” as part of achieving certification, have been adapted into all areas of our Treatment Plants enabling our small Dalby system to cope and be ready for projects such as ‘Desalination’ and ‘Coal Seam Water’.

Look forward to the certification process, not just the morning teas.