THE ROLE OF A WATER TREATMENT PLANT OPERATOR IN THE SUCCESSFUL IMPLEMENTATION OF A DRINKING WATER MANAGEMENT SYSTEM

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ABSTRACT

From 1 September 2014, New South Wales drinking water supplies must adhere to a quality assurance program or Drinking Water Management System (DWMS) that adheres to the Australian Drinking Water Guidelines 2011 (ADWG) Framework for the Management of Drinking Water Quality. Like any other management system, to successfully implement a DWMS relies upon ensuring that the associated management plans, operational procedures and related documents are reflective of and integrated into everyday working practices. It is the water treatment plant operator's that play an essential role in ensuring this occurs. This paper will present practical information to assist water treatment operators to successfully implement their organisations DWMS. It will draw upon the knowledge and experience gained in Victoria over the past ten years since the introduction of the Safe Drinking Water Act 2044 (Vic).

1.0 INTRODUCTION

From 1 September 2014, New South Wales drinking water suppliers, as defined in the Public Health Act 2010 (NSW), must adhere to a quality assurance program or DWMS that has been established to address the requirements of the Public Health Regulation 2012 (NSW). To meet the NSW legislative obligations a DWMS must adhere to the Australian Drinking Water Guidelines 2011 (ADWG) Framework for the Management of Drinking Water Quality ('the framework'). The ADWG are intended to provide a framework for good management of drinking water supplies, if implemented, will assure safety at point of use (NHMRC, 2011). A responsibility fulfilled by a water treatment operator daily is the protection of public health by the assurance that the drinking water supplied for consumer consumption is safe. As the water treatment facilities provide the key barriers to contamination to manage and control water quality hazards. A failure occurring at this point in the water supply system that is, not identified and acted upon in an appropriate and timely manner, can pose a serious public health risk.

The implementation of a DWMS that is aligned with the requirements of the framework is a proactive, preventative and risk based approach to drinking water safety assessment. It clearly sets an organisations management strategy for the production of safe reliable drinking water that is applicable to the source water being treated and the infrastructure / assets that are in place. As an operator it is important that you can work with the DWMS and that it works for you. For this to occur, operators must play an active role contributing to the DWMS content to ensure it, along with the associated management plans, operational procedures and related documents are **reflective of** and **integrated** into everyday working practices.

Over the past ten years, since the introduction of the Victorian Safe Drinking Water Act 2004 (Vic), water treatment operators in Victoria have incorporated into their skill set the principles of the framework. This has been through the implementation and review of the water authority's drinking water quality Risk Management Plans (RMPs).

The experience can provide NSW operators with some insight and practical tips as they too go through a similar process. Importantly, for all NSW water businesses, it highlights the essential role that water treatment plant operators play in the successful implementation of a DWMS.

2.0 DISCUSSION

A central component to a DWMS is the system analysis and management aspects; this being the identification and understanding of the hazards and events that can compromise drinking water quality, and the preventative measures and operational control necessary for assuring safe and reliable drinking water (NHMRC, 2011). The daily actions of a water treatment plant operator fulfil most of these requirements. This emphasizes the critical role of a water treatment plant operator to the relevance and functionality of an organisations DWMS. This was a significant issue identified by the Victorian Department of Health (DoH) during the initial RMP audits conducted, that being, the practices undertaken in the field did not match the requirements or content of the RMP (Wells and Sheehan, 2010). The following sections will discuss how operators can play an active role in the organisations DWMS by providing practical operational knowledge to ensure the risk management strategies are relevant and function in an operational setting.

2.1 Water Supply System Hazards and Risks

Identifying and assessing the risk of the water quality hazards, their source and hazardous events of a water supply system is the foundation of any DWMS. Water quality hazards are categorised as microbiological, chemical, physical and radiological. The risk that they pose is determined by the likelihood and the consequence of their presence. A high risk water quality hazard is one that is assessed as all most certain to be present and if it is present the consequence to public health is a very serious one. Typically, the greatest risk to public health is that posed by microbiological water quality hazards (NHMRC, 2011). Generally a Hazard Analysis Critical Control Point (HACCP) process is used for this purpose. Knowing and understanding the water quality hazards that exist within your water supply system determines the preventative barriers required to be in place to manage and control the risk(s) e.g. the selection of treatment processes. Importantly, it directs the barrier performance required to reduce the risk(s) to an acceptable level to ensure public health is protected.

An experienced operator will know well the water quality hazards that exist for their water supply system along with the risks posed and how it may vary. Water quality risk is dynamic in nature and will change in response to the season, to climatic events i.e. heavy rainfall, lower flow through the network, abnormal operating conditions or a change in raw water source. A water treatment plant operator will hold the knowledge concerning how the assets perform in response to changing water quality risks, what the triggers may be for a risk change and of the operational activities required to ensure barrier performance is optimised. This is valuable operational knowledge that should be reflected in the DWMS documentation as it underpins a proactive risk management approach.

Some examples of practical tips that draw on an operator's knowledge to integrate the risk management principles of the DWMS into daily activities are;

- At routine operator "tool box" meetings or similar include a discussion about water quality hazards and risks e.g. what changes have occurred for both raw

water and treated water, consider any source water supply issues and operational challenges that may occur;

- Consider water quality hazards and any drinking water safety risks when planning maintenance or other works (similar to a safety analysis before performing a task conduct a drinking water safety analysis); and;
- For key water quality parameters establish a set of trigger values that prompt assessment of the operational settings e.g. a raw water turbidity change of >25% over a period of days may prompt an assessment of the current coagulation dose rate, clarifier operation or filter backwash frequency.

2.2 Understand the Critical Control Point Plans and Operational Performance

A critical control point can be defined as a point within the water supply system at which control can be applied and which is essential to prevent a hazard or the risk posed is significantly reduced to an acceptable level (NHMRC, 2011). These are identified during the HACCP process and are usually a preventative barrier within the water treatment plant e.g. the disinfection process. These should be documented in the DWMS as Critical Control Point (CCP) Plans. A good CCP Plan will detail clearly and concisely the performance requirements for that point within the system.

An example of the type of information a CCP Plan should contain is listed below:

- A brief description of the water quality hazard(s) controlled and the consequence of suboptimal performance;
- Target performance criteria;
- Alert limits indicating sub-optimal barrier performance;
- Critical limits that signify potentially unsafe drinking water;
- Monitoring requirements – the how and when; and;
- Corrective action requirements.

Getting this right relies upon understanding the operational performance of the preventative barriers in place to control and manage water quality hazards. There is no point setting stringent operational performance criteria to satisfy the DWMS or supposed "design criteria" when in reality the asset has difficultly achieving it. The criteria expressed in the CCP Plans must be representative of operational conditions and performance. In addition, the monitoring must be accurate, reliable and representative without this the operators may experience difficultly complying with the CCP Plans. This can lead to operational settings that do not reflect the DWMS in an effort to avoid excessive alarms and plant shutdowns. An experienced operator will know the actual operational performance of an asset and will operate according to its capabilities rather than to a CCP Plan. It is critical that an organisation's water quality manager and/or technical team work closely with the water treatment operators in an effort to establish CCP Plans that work for the operators.

Some examples of practical tips that draw on an operator's knowledge to improve the functionality of CCP Plans in an operational setting are;

- Consult operators regarding CCP sampling and monitoring locations to assess if representative information is generated in a timely manner (operators will know sample line run times, any reading delays, the suitability of the instrument for the application, the performance of the instrumentation etc.);

- Periodically review the water treatment plants performance against CCP Plan criteria and discuss any deviations / breaches with the operations team to resolve issues;
- Regular review of SCADA alarm settings to check correspondence with CCP Plan criteria; and;
- A procedure for the management of SCADA alarm changes including provision to ensure settings are returned to CCP Plan criteria following adjustments for maintenance or works to be carried out.

2.3 Implementing Appropriate Preventative and Corrective Action

When reviewed in hindsight, many documented water quality incidents worldwide have a common theme; that is the incident may have been avoided or at least the risk to public health minimised if appropriate preventative and corrective action was undertaken in a timely manner. The term "failure to respond" is often referenced in these reviews. There could be numerous reasons why a response was inadequate causing a water quality incident to escalate. However, the aim of a successfully implemented DWMS is to provide water treatment operators with a structured strategy and the resources to act or respond to water quality risks in a proactive preventative risk management environment. This means that foreseeable water quality risks are identified early and that they are acted upon with prompt appropriate corrective action with a **focus** on the production of **safe drinking water**.

Some examples of practical tips to assist operators to identify and implement prompt action to manage water quality incidents are;

- Clearly identifiable alarm notifications particularly for all CCP alarms;
- Establish Operational Performance Monitoring (OPM) programs targeting high risk water quality hazards;
- A set of operational procedures and processes to respond to a change in water quality risk (particularly to elevated risk);
- Established and practiced water quality incident procedures (including notification and escalation processes);
- Instrumentation and equipment maintenance routines with activities and processes appropriate to the level of risk managed; and;
- Label CCP instrumentation in the field to draw attention to its criticality i.e. identify the treated water total chlorine residual analyser from the raw water chlorine residual analyser that is used for oxidation purposes.

2.4 Communication

Effective communication is essential to ensuring that the DWMS content is reflected in the field practices. Communication features strongly in almost every element of the framework. For example, a DWMS requires the development of a drinking water management policy, to establish communication protocols, to establish operational procedures, to record observations / results / outcomes and to provide various reports. In the context of drinking water management communication plays a central role in the production of safe drinking water. Clear and concise communication allows for the detection of trends, escalation of issues for preventive or corrective action in a timely manner, provides evidence of action taken or maintenance performed. This embodies good risk management practices.

Many of the findings and opportunity for improvements from the initial audits conducted by the Victorian DoH may have been addressed with improved communication. For example, one finding highlighted was the need for an improvement to equipment calibration records. This may consist of clear communication of instrument tolerance limits, acceptable drift, calibration practices, acceptable differences between laboratory and online instrument readings, improving record keeping e.g. record actual results rather than ticking a box, assessing the performance of an instrument and identifying unacceptable / poor performance. These communication initiatives greatly improve risk management practices.

Some further examples of practical tips to assist with the effective communication of the DWMS contents are;

- Communication and display of the organisations Drinking Water Quality Management policy;
- Provide operators with DWMS training with the opportunity to critique the operational contents – they will know if it is reflective of day to day practices;
- Prominently display the CCP Plans at the water treatment plant (preferably in the control room or close by for easy reference);
- Regular **team** meetings with emphasis and focus on water quality issues and risks e.g. discussing water quality data against process unit performance;
- Water quality and risk management training and awareness sessions e.g. process optimisation, nitrification and network health, incident notification and reporting.
- Review the operational data recorded e.g. calibration records, water quality data, plant observations (daily check sheets) is it communicating useful information in a clear and concise manner.

3.0 CONCLUSION

The practical tips presented in this paper aim to assist NSW water businesses to successfully implement their DWMS. By engaging with the water treatment operators relevant operational knowledge is reflected in the associated management plans, procedures and operational activities. This offers the best opportunity to integrate the risk management principles of a DWMS into the daily tasks required to produce safe and reliable drinking water. In doing so, as the Victorian DoH has observed over the past ten years, a successfully implemented and maintained DWMS (or in Victoria referred to as a RMP) results in a decline in the number of notifications made by water businesses to a public health regulator (DoH, 2014).

4.0 REFERENCES

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