

# MANAGING THE RISK – WATER TREATMENT PLANT CHEMICAL QUALITY CONTROL



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## ABSTRACT

Ensuring that the right chemical, of the right quality, is delivered into the right storage vessel, at the right site, at the right time is a challenge all Water Authorities face. This account details Gippsland Water's chemical quality journey. The journey culminates with the letting of a chemical supply contract with defined quality standards for all chemicals and the requirement that each chemical has a laboratory test certificate prior to delivery. The associated issues of delivery procedures and the gradual change in organisational culture are also presented.

## 1.0 INTRODUCTION

The problems associated with the quality, delivery and handling of chemicals at Water Treatment Plants are a worldwide phenomenon. However, instead of accepting these problems, Gippsland Water has sought to solve the problems by implementing a number of quality and safety initiatives. These initiatives demonstrate Gippsland Water's due diligence and duty of care to our staff, contractors and customers. The initiatives, which collectively form a "Chemical Quality Control Journey", are described below.

## 2.0 DISCUSSION

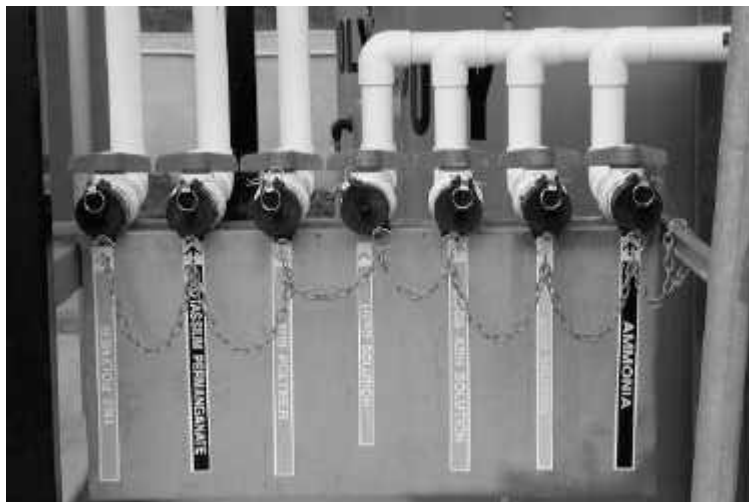
In 1995 on a routine visit to a Gippsland Water fluoride dosing facility, pallets full of polypropylene bags marked with Asian hieroglyphics were discovered. This "discovery" alarmed those responsible for the treatment of drinking water, as there was no adequate indication of the exact contents of the bag, its level of purity or indeed whether it was approved for potable use. In early 1999, a chemical ordered for a particular site was delivered into the wrong receiving vessel, leading to the generation of toxic gases and the hospitalisation of a tanker driver. In late 1999 the correct chemical, of incorrect strength was delivered leading to a disinfectant overdose.

These events have progressively influenced the design of Gippsland Water's total chemical supply system. Broadly the objective is to manage all issues associated with the acquisition, storage, use and handling of water treatment chemicals that have the potential to adversely impact upon the health and wellbeing of staff, contractors and customers.

In the absence of any Australian guidelines or testing procedures, Gippsland Water has, since 1996, been developing a system to ensure best practice chemical supply and use.

Gippsland Water has taken a multifaceted approach driven by internal occupational health and safety concerns, and the need to demonstrate due diligence with regard to the potential health effects on customers. The first stage in the journey was to clearly identify and label chemical storage vessels, filling points and delivery pipe work at all Gippsland Water sites (Figure 1). Prior to this, many sites had multiple unlabelled external cam lock fittings lined up next to one another, with the storage vessels hidden inside the building. Bunding was often either non-existent or inadequate. Improved bunding and appropriate tank venting has now been installed.

**Figure 1:** *Newly labelled cam lock fittings over chemical bund*



Prior to August 2000, Gippsland Water did not have a contract for the supply of treatment chemicals. Although one company supplied most of the chemicals, there were instances of staff ordering chemicals from whichever supplier could provide the most competitive price, or from a preferred local supplier. This practice provided no accountability for the quality of chemicals supplied, and records relating to the supply, delivery and use of particular batches of chemicals were incomplete or non-existent.

Gippsland Water made a strategic decision to progressively adopt NSF Standard 60 accreditation of treatment chemicals, and approached our largest supplier, local company Aluminates P/L, to attain this accreditation. Initially there was some reluctance to meet this request, as Gippsland Water was the only Water Authority in Australia making such demands. However, Aluminates P/L soon obliged and became the first chemical supplier in Australia to achieve NSF certification of their Morwell site for the manufacture of several large volume water treatment chemicals.

The next step involved the preparation of detailed quality specifications for each treatment chemical used by Gippsland Water. These specifications were incorporated into the Chemical Supply Contract. Preparation of the specifications was difficult. Since no Australian guidelines were available to assist in the preparation of the specifications, overseas experience was drawn upon. In addition to guidance from NSF, Gippsland Water utilised the Water Chemicals Codex and the American Water Works Association Standards and adapted them to suit local applications. Part of the specification required the supplier to provide a certified analysis of the product, and/or an affidavit stating that the product complied with all requirements (particularly chemical quality) of the specification. Gippsland Water was not prepared to accept the delivered product for use unless accompanied by this documentation.

Tenders for the supply and delivery of all treatment chemicals (with the exception of gaseous chlorine and liquid oxygen), which included the specifications, were advertised in late 1999. Almost thirty companies applied for the tender documents, but only two tenders were eventually submitted. During the tendering process, Gippsland Water received hostile inquiries about the requirement for NSF certification from several companies who failed to submit tenders. Few companies were prepared to venture down the track to achieve NSF certification to comply with the requirements of our specifications.

In fact, apart from the successful tenderer's bid, Gippsland Water was extremely disappointed by the lack of commitment of chemical supply companies to provide adequate guarantees that their product met the requirements of our specification. It must be noted that the maximum contaminant levels (based on the Water Chemicals Codex) mentioned in the specifications were not onerous.

The contract for the supply and delivery of treatment chemicals was let in August 2000 for an initial period of two years. The successful tenderer, Aluminates P/L, felt this period was insufficient to justify the necessary expenditure to meet the new requirements of the contract. A case was put to the Gippsland Water Board for a longer period and the contract period was extended to three years with the option of two further years.

Since the commencement of the contract a number of administrative and delivery procedures have been established and progressively implemented.

- Aluminates P/L appointed a full time Safety and Quality Assurance officer as part of a program to provide improved service delivery to their customers.
- A driver induction system has been established for each Gippsland Water site. Each driver is inducted onto each site and appropriate records kept. These include an individual driver record, which can be inspected by Gippsland Water operational and management staff at any time, and a central database reflecting the current site status of all drivers. The Gippsland Water staff member responsible for the site performs the site inductions.
- The requirement for a batch analysis certificate prior to delivery and acceptance by Gippsland Water has necessitated the establishment of quarantine tanks (Figure 2) at the Aluminates site. NATA accredited testing according to the requirements of the chemical specifications is undertaken while the chemicals are quarantined. Chemicals no longer leave the Aluminates site until the testing is complete and analytical reports received, showing compliance with the chemical quality specification.

**Figure 2:** *Gippsland Water's bulk alum quarantine tank at the Aluminates factory site*



- Formal checklists have been established to cover the dispatch and delivery process. A gross visual check is carried out on the product before it leaves the Aluminates site and an operator not directly involved with the batching process checks that the batching has been undertaken in accordance with work instructions. At the Gippsland Water site, the order is verified and both the Aluminates driver and the Gippsland Water operator ensure that the right chemical is delivered to the right storage vessel under safe operating conditions. A Chemical Delivery Checklist is filled out accordingly. An example of the Chemical Delivery Checklist can be found in Appendix A.

- In the past, delivery of chemicals could occur without the presence of a Gippsland Water operator. Chemicals can now only be delivered when an operator is present. The driver and the operator jointly complete Part 1 of the Chemical Delivery Checklist prior to the transfer of goods, and complete the second part of the checklist prior to the truck leaving the site and after the transfer is complete.

**Figure 3:** *Aluminates driver unloading chemicals from bulk road tanker*



- Product specific delivery hoses and factory storage vessels have been established at the Aluminates site. To further limit possible cross contamination Aluminates have implemented washing procedures for delivery vessels and hoses.
- Previously, delivery hoses were allowed to drain to the ground or in some cases to a confined area after completion of the delivery. To prevent this adverse and unsightly impact on the environment, an air purge system has been implemented to allow any product left in the hoses to be blown back to the tanker. The hoses are then capped prior to leaving the site.
- In the past there was no accountability for incorrect batching of chemicals or incorrect deliveries. Aluminates have now implemented a staff-training program that incorporates disciplinary and dismissal procedures.

The final step in the journey was the completion and refinement of documentation, including digital photographs and detailed maps of Gippsland Water sites, with the locations of fill points, storage vessels and safety equipment clearly identified. All this information is located in an Emergency box situated at the entry gates to the sites.

The information has also been distributed to the chemical supply company, to assist with tanker driver inductions onto Gippsland Water sites, and the documentation is stored in Gippsland Water's electronic document management system, where it is used for a wide variety of purposes. An additional benefit of this documentation has been a streamlining of the delivery process. Drivers are no longer getting lost or driving past inconspicuous driveways leading to dosing sites in remote areas.

Further security measures have been implemented in the wake of September 11. Tamper proof seals are now attached to bulky boxes, bulk tanker hatches and carboys. The use of these simple but effective devices provides an added level of reassurance. An example of a tamper proof seal is shown below in Figure 4.

**Figure 4:** *Tamper proof seal on 20L carboy.*



### **3.0 CONCLUSIONS**

The implementation of the chemical supply “package” has required a change of culture for both Gippsland Water operators and Alumina staff. Education and training sessions on risk management have been conducted for both groups. In general, the program has progressed well to date, and has been embraced by all concerned parties. A particularly difficult obstacle to overcome has been the identification of a suitable laboratory to carry out the necessary testing in the required timeframe. Delays in receiving results from laboratories led to delays in releasing product for use in the early stages of the contract. Stock inventory and control at the chemical factory has been improved since Alumina were provided access to Gippsland Water’s chemical storage tank levels via an Internet SCADA link.

Adoption of the chemical supply “package” has placed Gippsland Water in a position where due diligence, duty of care and best practice operating principles can be clearly demonstrated. The manner in which Gippsland Water operates with respect to the ordering, handling and use of treatment chemicals has taken HACCP principles into account, and the approach taken will neatly meet the requirements of the Safe Drinking Water Bill (developed from the Regulatory Framework for Drinking Water Quality in Victoria), which is the subject of current parliamentary debate.

### **4.0 ACKNOWLEDGEMENTS**

The authors wish to acknowledge the cooperation of Garry Fortington, Simon Aquilina, Peter Lietzau, and Ken Steel in the implementation of this project. The combined effort of these people has enabled Gippsland Water to possess a system of chemical quality control that other Water Authorities have now considered worthy of modelling.

### **5.0 REFERENCES**

- 1 Water Chemicals Codex, National Academy Press, Washington D.C. 1982
- 2 American Water Works Association, American National Standards.
- 3 Regulatory Framework for Drinking Water Quality in Victoria, Department of Human Services, Department of Natural Resources and Environment, August 2000.

### **APPENDIX A**



## CHEMICAL DELIVERY CHECKLIST

NUMBER

This form is to be completed by the Gippsland Water Operator and counter-signed by the delivery contractor.

\* White copy to be given to the contractor. \* Pink copy to remain on site in book.

\* Blue copy to be faxed to Head Office on 5174 0103, then order form in TRIM must be updated with delivery docket number and delivery checklist number.

**PRIOR TO TRANSFER OF PRODUCT:**

Delivery Site:		Mainpac Site Code:		Delivery Date:		Time in:	
Chemical(s) Delivered:				Quantity Delivered:		Delivery Docket Number(s):	
Delivery IBC Color(s):				IBC Asset Number(s):			
GW Operator Name (PRINT):				Contractor Name (PRINT):			

Documentation Check	YES	NO	Comments
Is the driver's ID and Site induction Current?			
Does Contractor's delivery docket match GW's order?			
Have visual checks and/or other pre-delivery requirements noted on the delivery docket been signed off as completed?			

Delivery of solid materials (e.g. bagged Soda Ash or Lime, Activated Carbon, Sodium Fluorosilicate, Chlorine tablets)

	YES	NO	Comments
Is the packaging in good condition?			
Are pallets shrink wrapped?			
Are the packages clearly labelled?			

Transfer Requirements for Liquid Products (Including bulk lime deliveries)

	YES	NO	Comments
Is contractor wearing appropriate PPE?			
Does receipt vessel have sufficient free capacity to receive delivery volume?			
Are receipt vessel and fittings in good condition?			
Does the product comply with the supplied laminated visual standard photographs?			

If the answers to all relevant questions above are YES, then please sign below.

GW Operator to sign below if product is acceptable and transfer can commence.	Contractor to sign below that product has been accepted and transfer can commence.
_____ GW Operator Signature	_____ Contractor Signature

**ONLY COMMENCE TRANSFER IF ALL ANSWERS ABOVE ARE YES AND SIGNATURES ARE RECORDED ABOVE.**

Removal of sludge	YES	NO	Comments
Was sludge removed?			

Post transfer checks	YES	NO	Comments
Was transfer completed without incident?			
Was residual product in hoses removed from site?			
Were dust caps on transfer points and hoses replaced?			
Has the transfer area been left in good condition?			

I declare that this form is a complete and accurate representation of the activities associated with the transfer of chemicals

_____ GW Operator signature	_____ Contractor signature
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