NORDICAL DIVING SERVICES

STATEMENT OF PURPOSE

THE ROLE OF DIVING IN THE PRODUCTION OF POTABLE WATER

Background

The Water Industry in Australia has for over 120 years worked to provide water of an acceptable quality to its customers. In so doing, obvious problems have been identified and in solving them water quality maintained and improved.

What is meant by the word quality in the context of potable water? A common definition put forward to describe quality is "fit for purpose" which translated to the water industry is "fit for drinking". Perhaps our customers can guide us here. Whenever a water quality incident arises the first question asked is "Is the water safe to drink?" What do they mean by safe? "Will it make them ill?" The second most common concern for customers is the aesthetic character of the water; does it taste and smell OK, does it look OK, does it dirty their washing? These customer expectations define our task.

The existing water supply systems have served us well for sometime, however there is an increasing expectation from government (and perhaps customers themselves) to improve and maintain higher standards at all times. Indeed the Victorian Stale Government is currently introducing legislation for a "New Regulatory Framework for Safe Drinking Water".

By simply maintaining the status quo we aim to continue to provide water of the existing quality. By investing in an improved knowledge of our systems, training of our staff and moderate capital and operational expenditure we can improve water quality.

Over the last decade there has been a change in the way in which the production and supply of drinking water has been managed. The traditional approach involved establishing treatment barriers to ensure safety. Associated with this was a reliance on the testing of the final product delivered to the customer. An obvious shortfall in this approach is that should off specification water be detected (often after a 2 day delay in getting results back from a laboratory) it is too late to do anything about it. This traditional approach is now being progressively replaced with a system based on the recognition of hazards and management of risks.

Guiding Documents and Principles.
Three important documents exist to provide guidance in the production of Potable Water.

The **Australian Drinking Water Guidelines** (ADWG) are part of the Commonwealth Government's 1992 National Water Quality Management Strategy. The Guidelines have recently been revised and are now in draft form (June 2002). The major change in the new edition is the addition of a section that provides a "Framework for a Preventative Strategy for Drinking Water Quality Management"

Hazard Analysis and Critical Control Point (HACCP) is a preventative risk management system that originated in the USA in the 1960's. The system was developed initially to reduce the risk of food poisoning in astronauts. Since then the system has been expanded throughout the world to cover all aspects of food production that might impact on the health of consumers. There are obvious similarities between food and water production and therefore the principles of HACCP have relevance for the water industry. Many Water Authorities are embracing HACCP either formally through accreditation or informally through the application of the principles provided by HACCP.

The Victorian State Government passed a **Safe Drinking Water Bill** in June 2003. This act provides details of further requirements for Victorian Water Authorities. The original draft included several of the elements and principles contained in the ADWG and HACCP.

The ADWG Drinking Water Quality Framework is based on twelve Elements.

1. Commitment to Drinking Water Quality Management.
2. Assessment of the Drinking Water Supply System.
3. Preventive Measures for Drinking Water Management.
4. Operational Procedures and Process Control.
5. Verification of Drinking Water Quality.
6. Management of Incidents and Emergencies.
7. Employee Awareness and Training.
8. Community Involvement and Awareness.
9. Research and Development.
10. Documentation and Reporting.
11. Evaluation and Audit.
12. Review and Continual Improvement.

The HACCP system in turn is based on seven principles.

1. Identification of the Hazards.
2. Determination of Critical Control Points. (CCP)
3. Establishing Critical Limits for each CCP.
4. Establishing a Monitoring System for each CCP.
5. Establishing Corrective Actions for deviations that may occur.
6. Establishing Verification Procedures.
7. Establishing Record Keeping and Documentation.

The integration of HACCP and the elements of the ADWG provide a powerful framework for a preventative strategy for drinking water quality management. A comprehensive program based on these principles will ensure the supply of high quality water at all times.

Hazards, Risks and Critical Control Points

One of the aims of water treatment and distribution system management is to reduce the risk to public health due to hazards in the water treatment and delivery process.

A hazard may be thought of as any potential danger to consumers. Hazards associated with water treatment include:

- Microbiological contamination (health)
- Chemical contamination (health)
- Turbidity and Colour contamination (health and aesthetics)

The best way to manage an identified hazard would be to remove the hazard. If this cannot be done then the best option is to control the hazard by **reducing the likelihood** of the event happening, or by **reducing the consequences** if the event does occur.

The distribution system represents one point in the system of delivery of water from the catchment to the customer where the quality of water can be adversely affected. Alternatively, if looked at another way, if the distribution system is managed correctly, water quality can be maintained and improved. As such the distribution system represents a critical control point in the language of HACCP.

Hazards in the distribution system include but are not limited to:

Microbiological

- Contamination of water after a mains break
- Contamination of water after mains replacement
- Leaking hydrant
- Backflow from a customers service to the distribution system
- Failed or inadequate disinfection
- Biofilm growth inside pipes

Physical

- Contamination of water from poorly maintained storage structures
- Contamination of water from corroded fittings.

The Role Of Diving.

Diving presents a management tool to reduce or remove the hazards associated with the accumulation of sediment in water storages and tanks. In addition it can further reduce the introduction of contaminants such as iron by the replacement or valves and fittings inside storages that are rusted and contributing iron to water in the distribution system.

Diving methods can also be used to assist in optimising disinfection by better designing disinfection contact structures to prevent short circuiting and increasing contact time by the introduction of skirts and baffles.

Regular inspection of assets allows efficient asset management practices to be implemented.

An emerging role for diving in the current climate of heightened security awareness is the emergency inspection of assets after break-ins.

Diving also has a role in the reduction of loss of water by leakage. Visual inspection allows the identification and repair of some sites responsible for the loss of water from storages.

Water Quality

Raw Water Basins and Storages

Raw water basins and storages by their very nature collect sediment at a rate proportional to the sediment load in the raw water. This accumulation of sediments impacts on the production of high quality water in several ways.

- Turbulence generated by water flow, wind or temperature changes stirs up sediment and increases the turbidity of the raw water to the WTP. This creates conditions that make treatment more difficult particularly if the events are infrequent and unpredictable.
- Accumulated sediments may store metals such as iron and manganese. Wind or flow generated turbulence may mobilise these at times with the increased risk of contributing these undesirable elements to the distribution system. If the storage is large enough temperature driven "turn over" of the water can also mobilise sediments and metals.

Clear Water Storages and Tanks

Water quality deteriorates as soon as the water leaves the WTP. Detention in storages ages the water and if this storage is long enough may impart a "stale" taste to the water.

Although the water leaving the WTP generally has a very low turbidity, over time the small amount that is present accumulates as sediment in the bottom of storages. High demands and the resultant increase in flow can disturb the sediment and carry it into the distribution system. This entrained sediment can be the cause of dirty water complaints.

Occasional overdosing with alum at the WTP can lead to "post floccing" in storages and reticulation system. This can also lead to the further accumulation of sediment and dirty water complaints.

Management

Traditionally basins and tanks have been taken off line to facilitate cleaning. The storage is drained and operational staff with squeegees and hoses clean the storage. This is time consuming and necessitates taking storages offline. This may be difficult or impossible for the time required. Modern diving procedures allow silt and sediment to be removed while the storage remains on line. Diving is performed hygienically and in such a way, using efficient vacuum systems, that the sediment is not stirred up. At worst the storage only needs to be taken offline while divers are working in the immediate area of the outlet for safety reasons. If the storage cannot be taken offline procedures are available that allow the outlet to be shielded to allow divers to continue to work.

Asset Management

The assets of the water industry are predominantly under ground or underwater. Inspection of assets underwater is made possible by the use of appropriately trained divers. The condition of ladders, valves and fittings can be inspected photographed and reported on without taking the storage off line.

One additional area is inspection of storages for leaks. In a country where water is limited, preventing loss via leaks is important.

Having inspected and reported on inspections action can be taken to remediate assets or alter the structures.

These activities include

Reduction of iron

- Replacement of corroded or weakened fittings
- Replacement of corroded valves and taps.
- Replacement of steel fittings with plastic fittings

Reduction of water loss by leakage

- In Situ repair of cracks holes or weakened sections
- Welding of weakened steel structures

Improved Water Flow for Improved Quality.

- Inlet and outlet structures can be modified to improve flow in storages removing stagnant pockets and minimising shortcircuiting. This is particularly important in chlorine contact structures
- Installation of skirts and baffles to improve flow and chlorine detention tank operation.

Nordical Diving Services Statement of Purpose.

Nordical Diving Services aims to actively contribute to the production of high quality water by the provision of water storage cleaning services and asset management for water quality and safety.