



Preparing Water Treatment Contract's



The purpose of this manual is to provide clients of Cogent Partners Pty Ltd with some tools that may assist them with choosing the correct water treatment provider.

I trust that you shall find this information of use; unfortunately it was necessary to limit the content. However; if at any time you have any concerns with your water treatment program, require a second opinion or assistance with compiling a Legionella Risk Management Plan or Water Treatment Specifications etc. please feel free to call me.

Gordon Gudgeon

A handwritten signature in black ink, appearing to read "Gordon Gudgeon".

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Water treatment chemicals tend to be generic, all chemical water treatment companies' use the same chemicals in their inhibitors and biocides. Most water treatment companies tend to have efficient preventative treatment programs and are also very ethical in their approach to their service.

However it is the experience, capability, dedication and work ethics of the persons, who carry out the services, make adjustments, complete service reports, collect samples and monitor results that make or break the performance of a water treatment program.

Good maintenance of your cooling tower or evaporative condenser is important for the safety and efficiency of your cooling system and the economic plant life; it is also your legal responsibility.

It is also important to be aware that all risks associated with cooling towers remains with the cooling tower owner or in some cases the person who is leasing the building (*this would depend on the lease agreement in place*).

A cooling tower owner or operator can not subcontract their risk to the water treatment provider or the mechanical services supplier.

Why Treat Cooling Water?

The answer to this question may be obvious to those of us who have experienced poorly maintained towers, however; it is worth mentioning here;

Poor water treatment provides an environment where four main problems will exist; **all have a direct impact on economic life of a cooling tower system;**

1. Scale
2. Corrosion
3. Microbiological Contamination
4. Fouling

Scale: Minerals such as calcium and magnesium are relatively insoluble in water and can precipitate out of water to form scale deposits when exposed to common conditions found in cooling towers.

Corrosion: Common metals used in cooling systems, such as mild steel, react with the oxygen in the cooling water system, which provides an ideal environment for the reversion of the metal to its oxide state. This reversion process is called corrosion.

Microbiological Contaminants: Cooling water systems provide an ideal environment for bacteria to grow, multiply and cause bio-fouling problems in heat exchangers.

Fouling: The deposition of suspended material in heat exchange equipment is called fouling. Foulants can come from external sources such as dust around the cooling tower or internal sources such as products of corrosion.

The following properties also have a significant effect on any cooling water program;

Conductivity: Cooling water treatment programs will function within a specific range of conductivity. The ranges will depend upon the characteristics of the make up water including the pH and the water treatment program in place.

pH: Control of pH is critical for the majority of cooling water treatment programs. In general, when pH is below recommended ranges, the chances for corrosion increase and when pH is above recommended ranges the chance of scale formation increases. The effectiveness of many biocides also depends on pH, therefore; high or low pH may allow growth and development of microbiological problems.

Alkalinity: Alkalinity and pH are related because increases in pH levels, indicates increases in alkalinity and vice versa. As with pH, alkalinity below recommended ranges increases the chances for corrosion, those above recommended range increase the chances for scale formation. When corrosion and scale problems exist, fouling will also become a problem.

Hardness: Hardness levels are usually associated with tendencies of cooling water to be scale forming or not. Chemical treatment programs require a hardness level to function correctly.

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How to Choose a Water Treatment Provider

Whilst companies such as **Cogent Partners Pty Ltd** can provide assistance with Legionella Risk Management Plans, independent Legionella monitoring programs and setting of Key Performance Indicators; the actual chemistry of the program is in the hands of the water treatment provider selected. It is important that a knowledgeable supplier be selected who can provide appropriate control systems and chemistry tailored to meet the cooling system and specific make up water quality.

Many water treatment companies tout ISO 9001:2000 certification as a “quality indicator”. However, all the ISO 9000 process means is that they have a quality assurance and control program for manufacture and delivery of their chemical products; it has no impact on the quality of the actual water management program on your site. ISO programs do little or nothing to indicate the potential for success of a proposed water management program. **When was the last time a water treatment provider brought a quality auditor on to your site to evaluate the performance and quality of a water treatment program?**

Usually only one program is offered for controlling scaling, corrosion etc. This helps to sustain the myth that any makeup water supply can be treated effectively by a single chemical. When considering such proposals you should always insist on a professional approach. **After all, you are legally responsible for the safety of your employees, customers, and the potential harmful chemicals being discharged to the sewer.**

Every cooling tower system presents a unique combination of equipment, water parameter, blowdown, heat load, fouling potential and control considerations. Proper selection of a sound water treatment program requires the collection of a considerable amount of information.

After making a detailed survey of the system including its design, materials of construction, current treatment, operating load and make up water chemistry a recommendation in the form of a proposal is made. Since monitoring a water treatment program is the key to success, the proposal must include the method of control monitoring and follow up. Corrective actions are required for an effective cooling water treatment program. The purpose of monitoring is to identify potential problems before they occur.

Wrong selection of water treatment chemicals can be harmful for the system and can cause the following direct or indirect losses to the cooling system;

- Loss of efficiency; due to scaling or biofilm
- Unnecessary shut downs
- Loss of metal and alloys; reducing the life of the equipment
- Leaks from welds or other weak spots in the system
- Algae growth in cooling tower; due to over dosing of phosphates and sunlight
- Loss of production
- Increases of costs due to corrective actions that may be require; acid cleans decontaminations etc.
- Numerous combinations of chemicals have been recommended for treating cooling water by various water treatment chemical manufacturing companies. Some perform well; others are virtually useless and some are harmful.

The Scope of Work of a Water Treatment provider should be;

- To do an initial survey i.e.; checks out the various properties of the water and survey the plant.
- Study the site Legionella Risk Management Plan and Water Treatment Specification.
- Design the water treatment program based on his survey and RMP and WTS.
- Implement the water treatment program and maintain the nominated KPI's
- Service and monitor the program regularly.
- Keep the system clean.
- Provide comprehensive reports back to the tower operator

It's only by carrying out the above procedures properly the water treatment company can produce the correct results, which are; *scale, biofilm, corrosion and fouling free systems in conjunction with efficient water usage.*

When requesting a quotation from a water treatment company, whether it be a chemical company or a non-chemical electrostatic water treatment company, you should request that a detailed description of their treatment method, equipment or chemicals to be used, dosing rates etc be included in the proposal.

Most water treatment companies in Australia are owned and managed by ethical people, however; it is not the management staff or the owners that service your site. The serviceman that visits your site each month may be a qualified chemist with excellent work ethics; on the other hand he may be incompetent, a corner cutter, inexperienced or just plain lazy and dishonest. The best practice way to assess the quality of a water treatment program and ensure the efficacy of the results is to appoint an independent company to carry out testing for KPIs such as corrosion rates and Legionella results.

Water Treatment Specifications

It is poor practice and leaving yourself open to poor service and possible scaling, corrosion and microbial problems, if you do not clearly state what your expectations are in your water treatment specifications. It is common for the tower owner to say "treat the tower to AS3666 Standard" or just leave it up to the water treatment companies to decide what to include in their proposals. This is a mistake; and shall lead to poor service and is not professional.

AS3666 is a minimum Standard and following this standard without taking into consideration the specific risks associated with your site is leaving yourself open to legal and financial liability.

There are other documents that should be considered when designing a Legionella Risk Management Plan; i.e. the '**Work Place Health & Safety Act 1995**', '**The Plant Code of Practice 2005**'; '**HB32**' and the '**Queensland Legionella Control Guidelines**' it is worth noting that the Work Place Health & Safety ACT requires a risk management process to be completed for all "High Risk Plant".

Best practice would be to draw up a 'Water Treatment Specification/Legionella Risk Management Plan' based on the specific risks and location of your cooling tower.

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These should include procedures to manage the 5 Critical Risk identified by AS3666;

- Stagnant Water
- Nutrient Growth
- Poor Water Quality
- Deficiencies in the Cooling Tower System
- Location and Access

If professionally prepared, a 'Water Treatment Specification/Legionella Risk Management Plan' that is based on the specific risks associated with your site and cooling tower, shall satisfy the current requirements of The Plant Code of Practice 2005 and AS3666. This document can also be issued to your water treatment company at the tendering stage, they can then provide a quotation to the standard of service that you require. The RMP/Specifications should also provide your water treatment company with KPI's, service requirements, corrective action and reporting procedures.

Key Performance Indicators (KPI)

You need to be aware of what is happening in your cooling system, one of the main mistakes that a tower operator can make is to view each monthly service report individually. This can lead to problematic trends being missed, I strongly suggest that Key Performance Indicators are graph and the trends evaluated every month.

The minimum KPI's should be;

Test	KPI (minimum)
Heterotrophic Colony Count	Less than 100,000cfu/ml
Legionella species	Less than 10cfu/ml
Scaling rate	No scaling
Dissolve iron	Less than 1ppm
Drift	No visible drift (<i>this is a minimum for visually monitoring only</i>)
Basin cleanliness	Clean to mildly dirty
Copper corrosion rates	Less than 0.005mm/yr
Stainless Steel corrosion rate	Less than 0.005mm/yr; with no pitting
Mild Steel corrosion rate	Less than 0.15mm/yr
Water efficiency	A minimum of 5 cycles

The important thing to remember about most water treatment service reports is that the parameters recorded are usually just tools that the serviceman uses to make judgments on the current program. This information is next to useless to the cooling tower owner/operator; what should be recorded on the service reports are, the results of your nominated KPI's; they actually mean something to you! KPI's can also be set as to service reliability, and the number of non-complying KPI's per year; I like the Victorian Dept of Health System where they allow expect at least a 90% compliance against the KPI's in a 12 month period for cooling towers.

I am not suggesting that you tell the water treatment company how to do water treatment, what I am suggesting; is that you tell them exactly the KPI's and results you expect and let them work out how they are going to achieve them.

Monitoring

There are certain KPI's in a cooling tower system that should be regularly monitored, these should include (*but not necessarily be limited to*);

- **Free Halogen;** the importance of monitoring and control of chlorine or bromine levels in cooling systems, which utilize oxidizing biocides such as chlorine or bromine, is very important. If a true free halogen residual is not maintained, biological deposition and/or under deposit corrosion will occur. If the free halogen residuals are too high, corrosion will occur.
- **Corrosion;** monitoring of cooling systems for general corrosion and pitting tendency are critical to assuring performance of a cooling system treatment program. Corrosion coupons can provide you data on the average corrosion rate over a given period. On line corrosion monitoring (via a system such as the Aquarius KPI) can give instantaneous readings of corrosion rates at any given time.
- **pH;** levels are crucial to the performance of a preventive water treatment program, chemicals used in cooling towers are pH sensitive. Often pH is controlled by the automatic dosing of sulphuric acid, it is strongly recommended that if acid is to be dosed into your condenser water, that you insist that an alarm system is installed that would send out a warning message to key personnel if the pH level is out of specification.
- **Calcium Balance** (or calcium recovery) is a comparison between the overall concentration factor within the system and the extent to which the calcium is concentrating. The scaling potential of the cooling water is a KPI that is often overlooked. By monitoring the calcium balance during each service visit the water treatment serviceman should be able to identify scaling conditions and take corrective actions before the scale effects the heat transfer efficiency.
- **Water Efficiency** the recent water shortages around Australia have increased the cost of water and the financial and environmental costs of operating cooling towers. These days the water efficiency of any cooling tower water treatment program should be a KPI.

How to ‘Reduce’ the Risks Associated with Operating a Cooling Tower

Proper maintenance is essential to reduce the risks associated with Legionella, and to reduce potential plant failure due to scaling, corrosion or fouling.

A ‘best practice preventive risk management program’ can be maintained by;

- Identify the specific risks associated with your towers and your site
- Based on the identified risks commission a Legionella Risk Management Plan (RMP) and Water Treatment Specification (WTS).
- Present the RMP and WTS to your prospective water treatment suppliers
- Appoint a water treatment company based on their experience, and capabilities. Cost cannot be ignored but it should be away down the list of reasons for choosing the successful supplier.
- Insist that the water treatment supplier abides by your RMP and WTP. Do not tell them how to do their job but make it clear what your KPI’s, and Service and reporting requirements are.
- Appoint an independent Laboratory to collect the samples for Legionella testing and Heterotrophic Colony Counts, this ensures that the results are accurate and removes any suggestion of tampering with the samples before they reach the laboratory.
- Consider also appointing the independent laboratory to monitoring the corrosion rates via the carrion rates
- Read the service reports each month and promptly respond to any repair or equipment concerns that are documented on the report.
- Graph or have the laboratory graph the Heterotrophic Colony Counts each month, and monitor the trend lines.
- Audit the service reports, tower cleaning reports, laboratory reports annually against the RMP and WTS, and use the results of the audit as a tool to decide whether you shall renew the water treatment contract.
- Review the RMP and WTS at least annually to ensure they are still relevant and up to date.
- Ensure that you retain all documentation and correspondence in relation to the water treatment and the cooling towers.
- Ensure that your log book is up do date and contains, all relevant information.
- Do not leave the Legionella Risk Management Plan and Water Treatment Specifications up to the water treatment company. They shall provide you with the service they want to provide, which in most cases shall not be in you or your companies best interests.
- Avoid at all costs ‘national’ Legionella Risk Management Plans and Water Treatment Specifications. Often these documents are drawn up by a consultant in another state, site unseen and without any considerations on the requirements and risks associated with the individual system or local conditions. **Each cooling tower system is different and each potentially has a different risk status and therefore requires site specific management plans and water treatment specifications.**

The Service Report

In addition to being the primary means of formal communication between the service provider and the system operator, the service report is an essential record of the water conditions prevailing in the system and therefore has **legal status**. As such it should be signed by the service provider and the operator and retained on file for at least 7 years.

A system operator is required to ensure that suitable tests are carried out to show that the risk of *Legionellosis* has been controlled and to keep adequate records. To do this, he also needs to have a working understanding of the significance of these tests.

Records should be kept giving details of all maintenance, water treatment, cleaning and disinfecting procedures with details of the work done and when. These records should be kept up to date, signed by the person doing the work, and be readily available for inspection by management or regulatory authorities.

A service report should clearly state the client company name and site address, the systems covered by the report, the water treatment contractor and person carrying out the checks and their signature. The report should be addressed to a named individual and should state to whom copies are to be distributed.

Relevant dates should always be filled in. Control values for chemical conations, dosing pump and control settings (current and recommended) should always be entered, with any blanks explained.

Faults and any risk factor must also be recorded and acted upon. Chemical stock levels and water consumption are often included.

I recommend that you ensure the report covers all relevant parameters including the quality of the mains water.

A suggested list of parameters is as follows;

- Conductivity
- pH
- Chlorides
- Calcium hardness
- Calcium balance
- Alkalinity
- Inhibitor
- Free chlorine (*if chlorine or bromine is being used as the biocide*)
- Millivolts (*if an ORP controller is in use*)
- Corrosion coupons (*chosen to match the metals in the cooling system*)
- Cleanliness
- Total Bacteria Counts
- Legionella
- Cycles of Concentration (water efficiency)

Independent Testing; it is becoming common and considered best industry practice for building managers and engineers to demand independent testing of their cooling towers. Using a company such as **Cogent Partners Pty Ltd** to carry out your regular Total Bacteria Counts and Legionella sampling, provides an assessment of the efficacy of the current water treatment service, independent of the water treatment contractor. This removes any bias which may be implied when the person engaged to carry out the preventative water treatment, is also taking samples to assess his own performance.

Legionella Risk Management Plans; are becoming standard practice for operators of cooling towers. It is becoming less acceptable for water treatment programs to be put in place without ensuring that the preventive measures are; **1) warranted, 2) effective, and 3) cover all the potential risks.** In Queensland *“The Plant Code of Practice 2005* along with the new *“Queensland Legionella Control in Cooling Towers Guidelines”* require that each cooling tower have a Legionella Risk Management Plan in place and that they are regularly audited and updated. It is also important to remember that, the **Work Place Health & Safety Act 1995** states that *“if a Code of Practice is in place it must be followed”*

Data Logging; many water treatment equipment manufacturers now supply ‘state of the art’ data logging systems such as the Aquarius KPI, for recording and monitoring key parameters, such as; ph, conductivity, oxidizing biocide levels, corrosion rates etc. These data loggers can be linked to your building management computer system, giving continuous readings of the conditions in the cooling tower, and an alarm if any parameter is out of specification. The other options with these new data logging systems, is that they can provide either a remote monitoring facility or the information can be stored in the memory to be down loaded at a convenient time by using a laptop computer.

Tower Cleanliness when reporting the cleanliness of a cooling tower, I suggest that you nominate a standard recognized KPI and use them as the your definitions for tower cleanliness in the water treatment specifications;

Basin cleanliness as defined by SAA HB32 1995
Clean; Free from visible sludge, foam, slime, including algae and fungi, rust, scale, dirt and deposit or accumulation of impurities, or any other foreign material. (Note that slime on basin, wall of ball float feels slippery) <i>Water Clear</i>
Mildly Dirty; Up to 3mm of sludge in a few isolated patches on walls and floors of basin, thin film of slime or algae on fill or in basin (slime or algae shown by slippery feel or color). <i>Water milky</i>
Very Dirty; Extensive sludge, slime or algae. <i>Water murky</i>

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The following is a list of Water Treatment Companies that are currently active in Queensland and Northern NSW. Cogent Partners include this list as a service to our customers; however we do not recommend any specific company.

Company	Contact	Telephone
Complete Water Treatment	Matt Petigrew	07 3899 8055
Drew Australia	Peter Croskerry	07 3633 0277
Ecolab Water Care Services	Marcus Warner	07 3492 0029
Hydro-Chem	Gavin Richardson	07 3344 3266
Hydroshield	Peter Townsend	07 3711 0261
Integera Water Treatment Solutions	Brian Franco	07 3422 2333
Permaclean Water Technologies Pty Ltd	Ron Vinson	07 5597 1900
Ozone 1	Stephen Devine	07 5596 2922
Nalco	Terry Kambouris	07 3340 7700

I apologize if I have missed anyone; if you are a Water Treatment Provider and would like your company name either added or removed from the above list please contact me.

Some of the key services provided by Cogent Partners Pty Ltd are;

- ✓ **Legionella Risk Audits**
- ✓ **Preparation of Legionella Risk Management Plans**
- ✓ **Preparation of *site specific* Cooling Tower, Water Treatment Specifications**
- ✓ **Legionella investigations and expert advice**
- ✓ **Corrosion monitoring and investigations**
- ✓ **Independent sampling and analysis of waters for Legionella and SPC**
- ✓ **Legionella Management Training Programs**
- ✓ **Chiller inspections with comprehensive reports**
- ✓ **Water efficiency audits and preparations of WEMP Part 2**
- ✓ **Preparation of Storm Water Plans and audits**
- ✓ **Indoor Air Quality Audits and Testing**

This manual was prepared for by Gordon Gudgeon of Cogent Partners Pty Ltd, as a service to Cogent Partners clients, any questions or comments please contact;

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