AUSTRALIAN CAPITAL TERRITORY

Public Health Act 1997

INSTRUMENT NO. 288 OF 2000

DETERMINATION OF A CODE OF PRACTICE

Pursuant to Section 133 of the *Public Health Act 1997*, **I, MICHAEL JOHN MOORE**, Minister for Health and Community Care, do by this instrument, hereby declare that:

1. the Code of Practice at Schedule 1 to be Code of Practice for the Operation of Cooling Towers and Warm Water Storage Systems for the purposes of the *Public Health Act 1997*;

2. the Explanatory Memorandum at Schedule 2 to be an Explanatory Memorandum to the Code of Practice for the Operation of Cooling Towers and Warm Water Storage Systems for the purposes of the *Public Health Act 1997*; and

3. the Code of Practice commences on the 1 September 2000.

DATED this 28th day of August 2000.

Michael Moore
Minister for Health and Community Care

ACT DEPARTMENT OF HEALTH AND COMMUNITY CARE

SCHEDULE 1

ACT Cooling Towers and Warm Water Storage Systems

Code of Practice 2000

CONTENTS

1. INTRODUCTION

(1) This document is intended to provide a framework for reporting and management relating to cooling towers and warm water storage systems in the Australian Capital Territory. The Department of Health and Community Care has formulated this Code of Practice so that any risks associated with cooling towers or warm water storage systems can be identified and managed to minimise the threat to the health of the people of the ACT.

(2) The process of risk minimisation will be facilitated through the identification, evaluation and implementation of actions in order to reduce the risk to human health. In achieving the goal of protecting public health through risk management, scientifically sound, cost-effective, integrated actions are the Department's primary concerns while taking into account social, ethical, political and legal considerations.

(3) This ***Code*** has been developed in consultation with cooling tower and warm water storage system owners, maintenance contractors and interest groups in the ACT.

For enquires related to this Code of Practice, please contact:

Health Protection Service (02) 6205 1700

August 2000

2. SCOPE

(1) This Code of Practice sets minimum requirements for the operation and maintenance of ***cooling towers*** and ***warm water storage systems*** in the Australian Capital Territory.

(2) This ***Code*** is determined under section 133 of the *Public Health Act 1997* and is enforceable under that ***Act***.

3. OBJECTIVE

(1) The *Public Health Act 1997* together with this Code of Practice are designed to avoid an outbreak of Legionellosis by:

- providing standards for the design, location, commissioning, operation and maintenance of ***cooling towers*** and ***warm water storage systems***;
- regular approved maintenance, inspections and keeping of records to ensure that such systems meet the standards; and
- allowing ***Public Health Officers*** (PHOs) to check, take samples for testing and for the ***Chief Health Officer*** (CHO), to require the shut down of a mechanical ventilation system and to require the evacuation of a building where a suspected outbreak of Legionellosis has occurred.

4. APPLICATION

(1) This Code of Practice applies to all non-domestic buildings that:

- are cooled by ***cooling towers***;
- have installed or contain ***evaporative condensers***; and
- have installed or contain ***warm water storage systems*** that are greater than or equal to 500 litres capacity.

(2) This Code of Practice does not apply to:

- ***hot water systems***;
- ***warm water storage systems*** that are less than 500 litres capacity;
- spa pools and hydrotherapy pools;[1] and
- ***evaporative air coolers***.[2]

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[1] The requirements for spa pools and hydrotherapy pools are detailed in the *ACT Swimming and Spa Pools Code of Practice* available from the Health Protection Service.

[2] Guidelines for the maintenance of evaporative air coolers can be found in the *ACT Guidelines for Evaporative Air Coolers* available from the Health Protection Service.

5. DEFINITIONS

(1) For the purposes of this Code of Practice, the definitions below apply. Throughout the ***Code***, terms or phrases that appear in ***bold and italicised*** identify those terms or phrases that have been defined.

Act—the ACT *Public Health Act 1997*.

Alkalinity—Acid neutralising or buffering capacity of water; a measure of the ability of water to resist changes in pH caused by the addition of acids or bases. It is expressed in units of milligrams per litre (mg/L) of $CaCO_3$ (calcium carbonate) or as microequivalents per litre (μeq/L) where 20 μeq/L = 1 mg/L of $CaCO_3$. A solution having a pH below about 5 contains no alkalinity.

AS/NZS 3666—the standard jointly published by Standards Australia and Standards New Zealand titled AS/NZS 3666—Air handling and water systems of buildings - Microbial control, and includes Parts 1, 2 & 3 of that Standard.

Authorised Medical Officer—means the officer appointed under section 13 of the Act.

Authorised Officer—means the ***Chief Health Officer***, a ***Public Health Officer***, or an ***Authorised Medical Officer***.

cfu/mL—colony forming units per millilitre.

Chief Health Officer—means the officer appointed under section 7 of the ***Act***.

Code—the *ACT Cooling Towers and Warm Water Storage Systems Code of Practice 2000* determined under section 133 of the ***Act***.

Conductivity—water's ability to conduct an electric current and is directly related to the total dissolved salts (ions) in the water. Properly named electrical conductivity (EC) and is reported in μS/cm (microSiemans per centimetre). EC is temperature sensitive and increases with increasing temperature. Most modern probes automatically correct for temperature and standardise all readings to 25°C and then refer to the data as *specific* EC.

Cooling Tower—a device for lowering the temperature of water by evaporative cooling in which atmospheric air is in contact with falling water, thereby exchanging heat. Cooling towers include ***evaporative condensers***.

Department—the ACT Department of Health and Community Care.

DPD Test Kit—a kit for measuring free, combined and total chlorine residuals using the reagent DPD (*N,N*-diethyl-1,4-phenylene diamine or *N,N*-diethyl-ρ-phenylene diamine). Many test kits available from swimming pools suppliers measure only total chlorine and not free chlorine and consequently should not be used. Free chlorine residuals is excess of 10 mg/L are capable of bleaching the indicator colour, rendering the test invalid. Samples of water may have to be diluted with distilled water, or other water, which does not interfere with the test, to bring the sample within the range of the test kit. Allowance must be made for the sample dilution factor when determining the free chlorine residual in the original sample.

Evaporative Air Coolers—a device that effects a reduction in the dry bulb temperature of air by evaporating water into air.

Evaporative Condenser—a heat exchanger in which refrigerant is cooled by a combination of air movement and water spraying.

Extraneous Matter—any matter, whether of plant, animal or inorganic origin, that may adversely affect the operation of the system or increase the risk to public health.

Good Working Order—operating according to manufacturers' specifications and presenting no risk to public health. For example, a system that is leaking water may be operating according to manufacturer's specification, however, it does present a risk to public health due to potential aerosolisation of leaking water and reduction in biocide concentration.

High Risk Event—an event that could reasonably be expected to significantly adversely affect public health.

High Risk Sites—includes major shopping malls, hospitals, aged care facilities and other like facilities as determined by an ***authorised officer***. A list of current high risk sites is available from the Health Protection Service.

Hot Water Systems—systems that heat water to or above 60°C.

mg/L—milligrams per litre.

pH—a term used to describe the hydrogen ion concentration in water. A solution of pH 0 to 7 is acid, pH 7 is neutral, and pH 7 to 14 is alkaline.

Practising Engineer—an engineer registered with the National Engineering Registration Board (NPER) to the level of NPER-3 and registered to practice in the areas of mechanical engineering or building services engineering.

Public Health Officer—means the officer appointed under section 12 of the ***Act***.

Registered—a ***cooling tower*** or ***warm water storage system*** registered under section 56G of the ***Act***.

Registered Person—means a person registered under section 56G of the ***Act*** to carry on a registered activity. The registered person may include his/her representative.

Registration Certificate—a certificate issued under section 56H of the ***Act***.

Significant Modification—a modification to a ***cooling tower*** or ***warm water storage system*** that directly affects the operation of the system. For example, addition of drift eliminators to a ***cooling tower*** is a significant modification. However, installation of a new type of ball float is not a significant modification.

Standard—AS/NZS 3666

TDS—total dissolved salts or solids in a volume of water, usually expressed in mg/L. TDS can be estimated by ***conductivity***.

Warm Water Storage Systems—includes non-domestic warm water storage tanks that maintain a water temperature of between 30°C and 60°C.

6. REFERENCED DOCUMENTS

(1) The following documents have been used as reference for this ***Code***.

1. AS/NZS 3666—Air-handling and water systems of buildings - Microbial control.
2. AS/NZS 3666.1—Air-handling and water systems of buildings - Microbial control. Part 1: Design, installation and commissioning.
3. AS/NZS 3666.2—Air-handling and water systems of buildings - Microbial control. Part 2: Operation and Maintenance.
4. AS/NZS 3666.3—Air-handling and water systems of buildings - Microbial control. Part 3: Performance-based maintenance of cooling water systems.
5. AS/NZS 3896—Examination for legionellae including Legionella pneumophila.
6. AS 4276.3.1—Water Microbiology - Heterotrophic colony count methods - Pour plate method using plate count agar.

(2) Further documents of interest include:

1. Standards Australia, HB 32:1995 Control of microbial growth in air-handling and water systems of buildings.
2. C. Broadbent, *Guidance for the control of legionella*, National Environmental Health Forum Monographs, Water Series No. 1, South Australian Health Commission, 1996.
3. Australian Institute of Refrigeration Air Conditioning and Heating, *Cooling Towers Selection & Application*, AIRAH Application Manual DA 17.
4. Australian Institute of Refrigeration Air Conditioning and Heating, *Water Treatment*, AIRAH Application Manual DA 18.

7. ADOPTION OF AS/NZS 3666

(1) This ***Code*** adopts ***AS/NZS 3666*** and compliance with this standard is to be enforced.

(2) The edition of ***AS/NZS 3666*** to be used is the current, or latest version, of the ***Standard***.

(3) Where a section of ***AS/NZS 3666*** is inconsistent with a provision of this ***Code***, the provision of this ***Code*** shall be taken to prevail to the extant of that inconsistency.

(4) Compliance to ***AS/NZS 3666*** is required where the ***Code*** does not address an issue. For example, the ***Code*** does not address regularity of cleaning ***cooling towers***. This issue is addressed in ***AS/NZS 3666*** and is an enforceable requirement under the ***Act***.

8. ADDITIONAL REQUIREMENTS

8.1. COOLING TOWERS—GENERAL REQUIREMENTS

(1) All ***cooling towers*** must comply with the following general requirements in addition to the requirements detailed in the ***Standard*** that are not addressed by this ***Code***.

8.1.1 OPERATING PARAMETERS

(1) All ***cooling towers*** must be operated in accordance with the performance criteria and the operating control ranges detailed in the ***practicing engineer's*** risk assessment of the ***cooling tower*** undertaken under sections 8.1.9 of this ***Code***.

8.1.2 WATER QUALITY

(1) Cooling Tower Water Sampling

(1a) Sampling of ***cooling tower*** water must be undertaken monthly in accordance with Appendix A to AS/NZS 3666.3.

(1b) A minimum of two samples of ***cooling tower*** water must be taken. The first sample for the determination of *Legionella* bacteria concentration. The second sample for the determination of heterotrophic microorganism concentration.

(1c) When sampling cooling tower water for microbiological analysis, the sampler must record the temperature of the water and the operating cycle of the cooling tower.

(2) Legionella

(2a) There must be no more than ten *Legionella* bacteria per millilitre of water in the ***cooling tower***.

(2b) The monthly ***cooling tower*** water sample must be analysed for *Legionella* bacteria by a NATA accredited laboratory in accordance with AS/NZS 3896, or an equivalent peer reviewed method.

(2c) Where a result is returned for ***cooling tower*** water with 10 or more *Legionella* bacteria per millilitre, the ***registered person*** of the ***cooling tower*** must instigate the appropriate control strategy as detailed in Appendix A to this ***Code***.

(3) Heterotrophic Microorganisms

(3a) There must be no more than 100,000 cfu/mL of heterotrophic microorganisms in the ***cooling tower*** water.

(3b) The monthly ***cooling tower*** water sample must be analysed for heterotrophic microorganisms by a NATA accredited laboratory in accordance with AS 4276.3.1 using the 35°C method, or equivalent peer reviewed method.

(3c) Where a result is returned for ***cooling tower*** water with 100,000 cfu/mL or more of heterotrophic microorganisms, the ***registered person*** of the ***cooling tower*** must instigate the appropriate control strategy as detailed in Appendix B to this ***Code***.

8.1.3 DRIFT ELIMINATORS

(1) Drift eliminators are a vital part of preventing Legionnaires' disease outbreaks from ***cooling towers***, and also help retain the ***cooling tower's*** chemically treated water.

(2) After the commencement of this ***Code***, all new cooling towers must be fitted with drift eliminators which have a maximum drift loss not exceeding 0.02 per cent at the maximum design water circulation rate. Upon application for registration, the applicant, being the proposed ***registered person*** of the ***cooling tower***, must supply a ***practicing engineer's*** certificate to the ***Department*** certifying that the drift eliminators comply with the requirements.

(3) After the commencement of this ***Code***, all cooling towers must have drift eliminators, which have a maximum drift loss not exceeding 0.02 per cent at the maximum design water circulation rate, installed by 30 June 2003. The ***registered person*** of the ***cooling tower*** must supply a ***practicing engineer's*** certificate to the ***Department*** certifying that the drift eliminators comply with the requirements within one month of installation of the drift eliminators.

8.1.4 AUTOMATIC BLEED OFF

(1) All ***cooling towers*** must have equipment installed that provide for the automatic bleed off of ***cooling tower*** water when the ***conductivity*** of the ***cooling tower*** water has

exceeded the upper operating control range for ***conductivity*** to waste to limit the build-up of dissolved and non-dissolved solids, in accordance with Section 8.1.4, paragraphs (2) and (3).

(2) After the commencement of this ***Code***, all new ***cooling towers*** must be fitted with automatic bleed off equipment prior to registration. Upon application for registration, the applicant, being the proposed ***registered person*** of the ***cooling tower***, must supply a ***practicing engineer's*** certificate to the ***Department*** certifying that the ***cooling tower*** has been fitted with automatic bleed off equipment.

(3) After commencement of this ***Code***, all existing ***cooling towers*** must have automatic bleed off equipment installed by 30 June 2003. The ***registered person*** of the ***cooling tower*** must supply a ***practicing engineer's*** certificate to the ***Department*** certifying that the ***cooling tower*** has been fitted with automatic bleed-off equipment within one month of installation of the automatic bleed-off equipment.

8.1.5 AUTOMATIC DOSING

(1) Chemicals for the control of microbial growth, corrosion, scaling and fouling must be added to the ***cooling tower*** water by automatic dosing equipment. Dosing equipment that drip feed chemicals for the control of microbial growth, corrosion, scaling and fouling into the ***cooling tower*** water are not considered automatic.

(2) A bleed lock-out must be installed to prevent bleed off to drain operating whilst biocide is being dosed. A bleed lock-out is not required when oxidising biocides are being dosed using ORP (oxidation/reduction potential) control.

(3) After the commencement of this ***Code***, all new ***cooling towers*** must be fitted with automatic dosing equipment prior to registration. Upon application for registration, the applicant, being the proposed ***registered person*** of the ***cooling tower*** must supply a ***practicing engineer's*** certificate to the ***Department*** certifying that the ***cooling tower*** has been fitted with automatic dosing equipment.

(4) After the commencement of this ***Code***, all existing ***cooling towers*** must have automatic dosing equipment with lock-out installed by 30 June 2003. The ***registered person*** of the ***cooling tower*** must supply a ***practicing engineer's*** certificate to the ***Department*** certifying that the ***cooling tower*** has been fitted with automatic dosing equipment within one month of installation of the automatic dosing equipment.

8.1.6 GOOD WORKING ORDER

(1) All ***cooling towers*** must be kept in ***good working order***.

8.1.7 SHUT DOWN

(1) All ***cooling towers*** must have a written shut down procedure displayed near to the ***cooling tower***. The written shut down procedure must be protected from weathering.

(2) If at any time the shut down procedure is not visible or cannot be read, it must be replaced immediately.

8.1.8 STAND-BY SYSTEMS

(1) ***Cooling towers*** that are on stand-by must be run at least one hour per week to circulate corrosion inhibitors and biocide. Stand-by systems must comply with this ***Code***.

8.1.9 RISK ASSESSMENT

(1) A ***practising engineer*** must undertake a risk assessment for ***cooling towers*** every five years or as directed by an ***authorised officer*** in accordance with Section 2 of AS/NZS 3666.3. Copies of the five-yearly risk assessment undertaken by the ***practising engineer*** must be submitted in writing to the ***Department*** within one month of the assessment.

(2) The risk assessment must be reviewed if:
- there are any reasons to believe that the findings are no longer valid;
- monitoring reveals the need for preventative or corrective action; or
- significant changes in work practices occur.

(3) The risk assessment must include:
- an assessment of all the risk factors detailed in Table 2.1 of AS/NZS 3666.3; and
- a statement of the performance criteria and operating control ranges for ***total alkalinity***, chlorides, ***conductivity/TDS***, pH and temperature.

(4) After the commencement of this ***Code***, the ***registered person*** of a newly installed ***cooling tower*** must supply a copy of the risk assessment upon application for registration.

(5) After the commencement of this ***Code***, the ***registered person*** of existing ***cooling towers*** must supply a copy of the risk assessment to the ***Department*** within 12 months of commencement date of this ***Code***.

8.2. COOLING TOWERS AT HIGH RISK SITES

(1) In addition to complying with section 8.1 of this ***Code***, all ***cooling towers*** at ***high risk sites*** must comply with the following additional requirements for ***cooling towers*** at ***high risk sites***.

8.2.1 DECONTAMINATION

(1) ***Cooling towers*** at ***high risk sites*** must be fully decontaminated at three monthly intervals in accordance with the requirements in Appendix C of AS/NZS 3666.3.

8.2.2 EXTRANEOUS MATTER

(1) ***Cooling towers*** at ***high risk sites*** must, as far as practicable, be prevented from being contaminated by ***extraneous matter***.

8.3. WARM WATER STORAGE SYSTEMS

(1) ***Warm water storage systems*** must comply with the following requirements and any requirements detailed in the ***Standard*** that are not addressed by this ***Code***.

8.3.1 WATER QUALITY

(1) There must be no more than ten *Legionella* bacteria per millilitre of water in the ***warm water storage system***.

(2) Water sampling of ***warm water storage systems*** must be undertaken every two months in accordance with Appendix A to AS/NZS 3666.3.

(3) The ***warm water storage systems*** water samples must be analysed for *Legionella* bacteria by a NATA accredited laboratory using AS/NZS 3896, or an equivalent peer reviewed method.

(4) Where a result is returned for ***warm water storage systems*** with 10 or more *Legionella* bacteria per millilitre, the ***registered person*** of the ***warm water storage system*** must instigate cleaning and disinfection as detailed in Appendix C to this ***Code***.

8.3.2 CLEANING AND DISINFECTION

(1) ***Warm water storage systems*** must be cleaned and disinfected every three months as per the requirements in Appendix C to this ***Code***.

9. NOTIFICATION OF HIGH RISK EVENTS

(1) The ***registered person*** of a ***cooling tower*** or ***warm water storage system*** must notify the ***Department*** within 24 hours after receiving a result of greater than 100 *Legionella* bacteria per millilitre, or after receiving a result of greater than 5,000,000 cfu/mL of heterotrophic microorganisms, or other ***high risk event***.

(2) Examples of ***High Risk Events***[3]

- Severe ***cooling tower*** water leakage.
- Start-up after extended period of time where the ***cooling tower*** water is not being biocide treated.

(3) Contact details for notification of ***high risk events*** are:

Environmental Health Unit
Health Protection Service
Phone: (02) 6205 1700 (bh) [NB. if after normal business hours please phone pager number given on answering machine]
Facsimile: (02) 6205 1705 (fax)

10. RECORDS

10.1. MATERIAL SAFETY DATA SHEETS

(1) Material Safety Data Sheets must be kept for all chemicals in use on the premises and stored close to where the chemicals are stored.

10.2. GENERAL REPORTING REQUIREMENTS

(1) Maintenance records and microbial testing records must be kept at a place agreed between the ***registered person*** and an ***authorised officer*** and be available for inspection by authorised officers.

(2) All maintenance and microbial testing records must be kept for a minimum of two years.

(3) The maintenance and microbial testing records may be combined into a single report. However, records of this nature must contain all the specified information as detailed in sections 10.3 and 10.4, except overlapping information.

10.3. MAINTENANCE RECORDS

(1) Maintenance records must contain the following information:

- ***registered person's*** name;
- name and address of the owner/manager of the building;
- name and address of the building;
- location details of the ***cooling tower*** or ***warm water storage system***;
- registration number of the ***cooling tower*** or ***warm water storage system***;
- name and address of the organisation undertaking the maintenance;
- date of maintenance;
- details of the maintenance undertaken; and

[3] High risk events are not limited to the examples given.

- assessment of the general condition of the ***cooling tower*** or ***warm water storage system*** (e.g. amount of rust present, if any).

10.4. MICROBIAL TESTING RECORDS

(1) Microbial testing records include *Legionella* testing records and heterotrophic microorganism testing records.

(2) The microbial testing records must contain the following information:
- ***registered person's*** name;
- name and address of the owner/manager of the building;
- name and address of the building;
- location details of the ***cooling tower*** or ***warm water storage system***;
- registration number of the ***cooling tower*** or ***warm water storage system***;
- name of the person whom took the sample (and their employer);
- date and time of sampling;
- temperature of the cooling tower water upon sampling;
- operating cycle of the cooling tower when sampling;
- name and address of the laboratory conducting the analysis;
- NATA accreditation number of the laboratory;
- laboratory's unique identifier number for the sample;
- the method used for determining the results; and
- results of testing.

10.5. SUBMISSION OF RECORDS

(1) Copies of maintenance and microbial testing records must be submitted to the ***Department*** within 14 days of 31 March, 30 June, 30 September and 31 December for the preceding three months.

11. ADMINISTRATIVE

11.1. CERTIFICATION

(1) A ***practising engineer*** is required to certify a ***cooling tower's*** or ***warm water storage system's*** compliance to this ***Code***. A copy of the certification shall be submitted in writing to the ***Department*** upon application for registration or upon request by an ***authorised officer***. This part applies only to new cooling towers or warm water storage systems that are not currently ***registered*** or licensed.

(2) Where any ***significant modification*** to a ***cooling tower*** or ***warm water storage system*** takes place, a ***practising engineer*** must certify the cooling tower's or warm water storage system's compliance to this ***Code***. A copy of the certification shall be submitted in writing to the ***Department*** within one month of the modification or upon request by an ***authorised officer***.

11.2. NOTIFICATION OF CHANGES

(1) The ***registered person*** must, within 14 days of any change in the information specified in the ***registration certificate***, notify the ***Department*** in writing of that change.

APPENDIX A

Control Strategies for the Control of Legionella

Test Result (cfu/mL)	Required control strategy
Not detected (<10)	(1) Maintain monthly monitoring Maintain water treatment program
Detected as between 10 and < 100	(2) Investigate problem. Review water treatment program. Take necessary remedial action including immediate on-line disinfection in accordance with Appendix B of AS/NZS 3666.3 and undertake control strategy (3)
	(3) Retest water within 3 to 7 days of plant operation after on-line disinfection: (a) If not detected, continue to retest water within 3 to 7 days until two consecutive samples, as appropriate, return readings of not detected and repeat control strategy (1) (b) If detected at <100 ***cfu/mL***, repeat control strategy (2) (c) If detected at ≥100 ***cfu/mL***, undertake control strategy (4).
Detected as ≥ 100	(4) Investigate problem. Review water treatment program. Take necessary remedial action including immediate system decontamination in accordance with Appendix C of AS/NZS 3666.3 and undertake control strategy (5) Notify the ***Department***.
	(5) Retest water with 3 to 7 days of plant operation after system decontamination: (a) If not detected, continue to retest water within 3 to 7 days until two consecutive samples, as appropriate, return readings of not detected and repeat control strategy (1). (b) If detected at <100 ***cfu/mL***, repeat control strategy (2). (c) If detected at ≥100 ***cfu/mL***: • repeat control strategy (4); or • shut down and clean cooling water system and then repeat control strategy (3).

APPENDIX B

Control Strategies for the Presence of Heterotrophic Microorganisms

Test Result (cfu/mL)	Required control strategy
Detected as < 100 000 (< 1×10^5)	(1) Maintain monthly monitoring. Maintain water treatment program
Detected as between 100 000 and < 5 000 000	(2) Investigate problem. Review water treatment program. Take necessary remedial action including immediate on-line disinfection in accordance with Appendix B of AS/NZS 3666.3 and undertake control strategy (3)
	(3) Retest water within 3 to 7 days of plant operation after on-line disinfection: (a) If test result is < 100 000 ***cfu/mL*** repeat control strategy (1) (b) If test result is ≥ 100 000 ***cfu/mL*** but < 5 000 000 ***cfu/mL*** undertake control strategy (2) (c) If test result is ≥ 5 000 000 ***cfu/mL*** undertake control strategy (4)
Detected as ≥ 5 000 000	(4) Investigate problem. Review water treatment program. Take necessary remedial action including immediate system decontamination in accordance with Appendix B of AS/NZS 3666.3 and undertake control strategy (5) Notify the Department
	(5) Retest water with 3 to 7 days of plant operation after system decontamination (a) If test result is < 100 000 ***cfu/mL*** repeat control strategy (1) (b) If test result is ≥ 100 000 ***cfu/mL*** but < 5 000 000 ***cfu/mL*** repeat control strategy (4) (c) If test result is ≥ 5 000 000 ***cfu/mL***, investigate problem and review water treatment program, immediately carry out system decontamination in accordance with Appendix C of AS/NZS 3666.3, and repeat control strategy (4) or shut down and clean cooling water system and then repeat control strategy (3).

APPENDIX C

Cleaning and Disinfection of Warm Water Storage Systems

1. Cleaning

Warm water storage systems must be drained and cleaned to remove sludge and sediment.

2. Disinfection

Warm water storage systems must be disinfected by one of the following methods:

A. Heat Disinfection

(i) Take reasonable precautions to ensure that the risk of scalding to building occupants is reduced during the heat disinfection process.

(ii) Raise the temperature of the water in the ***warm water storage system*** to 70°C. Flush each outlet in turn for two minutes with water at a minimum temperature of 60°C.

(iii) Heat disinfect systems which lie idle for two or more weeks as per (i) and (ii) above, prior to use.

B. Chlorine Disinfection

(i) Isolate the heat source.

(ii) Drain any sludge from the bottom of the ***warm water storage system***.

(iii) Ensure that an air break is incorporated between the water supply main and the ***warm water storage system*** to prevent contamination of water within ACTEW's distribution system.

(iv) Add sodium hypochlorite solution to produce a free chlorine residual of approximately 10 ***mg/L*** in the ***warm water storage system*** as measured by a ***DPD Test Kit*** or similar test kit. Maintain the ***pH*** of the water between 7.0 and 7.6.

(v) Ensure thorough mixing and circulation throughout the ***warm water storage system*** and any ring main.

(vi) Flush each outlet in turn until there is a distinct smell of chlorine. If there is any doubt, check the free chlorine level with a ***DPD Test Kit*** or similar test kit.

(vii) Check that the free chlorine residual in the water is not less than 7 ***mg/L*** at one outlet, preferably the furthest point downstream of the ***warm water storage system***.

(viii) Allow the water to stand for one hour.

(ix) Check that the free chlorine residual in the water is not less that 2 ***mg/L*** at the outlet used in (vii).

(x) Repeat the above procedure if the free chlorine residual is less than 2 ***mg/L***.

(xi) Drain the ***warm water storage system*** if the free chlorine residual is 2 ***mg/L*** or greater and refill the ***warm water storage system*** with water and re-commission the system.

(xii) Record details in a maintenance log book.