Fresh Water Cooling Towers Scheme for Air Conditioning Systems

November 2010

Energy Efficiency EMSD

Contents

Definitions

In this Scheme Brochure, unless the context otherwise specifies,

"cooling tower" means any device for lowering the temperature of water by evaporative cooling in which ambient air is in contact with falling water, thereby exchanging heat; "drift" means water lost from the cooling tower as liquid droplets or aerosols entrained in the exhaust air, excluding condensation.

Part 1: Introduction

1 Background

The Preliminary Phase Consultancy Study on Wider Use of Water-cooled Air Conditioning Systems (WACS) in Hong Kong was completed in mid 1999. The study has established that WACS has greater environmental, economic and financial benefits than Air-cooled Air Conditioning Systems (AACS). Subsequently, a territory-wide implementation study was completed in mid 2003 for facilitating a full-scale implementation of WACS. The implementation study examined and identified areas suitable for wider use of WACS and also examined in detail the financial, regulatory, land administration, infrastructural, environmental and health issues, including the prevention of Legionnaires' disease.

An inter-departmental working group was set up to launch a pilot scheme on 1 June 2000 for wider use of fresh water in evaporative cooling towers in energy efficient air conditioning systems (the Pilot Scheme) in designated areas where existing water supplies and sewerage network would be adequate to meet the additional demand. Although both sea water and fresh water can be used as the condensing cooling media, the Pilot Scheme is only applicable to fresh water evaporative cooling after considering the source and capacity of existing water supply networks. The working group comprises members from two policy bureaux and seven government departments:

- Development Bureau (DEVB)
- Environment Bureau (ENB)
- Buildings Department (BD)
- Drainage Services Department (DSD)
- Electrical and Mechanical Services Department (EMSD)
- Department of Health (DH)
- Lands Department (LandsD)
- Planning Department (PlanD)
- Water Supplies Department (WSD)

The interim reviews in 2005 and 2007 of the Pilot Scheme have revealed the Scheme has been a promising way to ascertain the energy efficiency in air conditioning systems for new and existing non-domestic buildings without posing adverse impacts on the existing water supply and sewerage infrastructures. As a result, with support of the policy bureaux concerned, the Pilot Scheme has operated as a standing scheme from 1 June 2008, and renamed as "Scheme for Wider Use of Fresh Water in Evaporative Cooling Towers for Energy-efficient Air Conditioning Systems" (or Fresh Water Cooling Towers Scheme in simple term). The regulatory and institutional framework of the Scheme basically remained unchanged except some updates in the operational and validation requirements.

A further review was also conducted in 2010 to streamline the application procedures and requirements for joining the Scheme. The Scheme Brochure is updated accordingly.

2 The Scheme

2.1 Aim

The Scheme aims to :

(a) promote energy-efficient water-cooled air conditioning systems;

(b) monitor the additional water demand;

(c) monitor the quantity and quality of bleed-off effluent discharge from the systems;

(d) monitor the health and environmental effects arising from the systems; and

(e) compile data for formulating and updating plans to promote water-cooled air conditioning systems in Hong Kong.

2.2 Conditions of Participation

This scheme applies to all non-domestic types of new and existing buildings within the designated areas (see para. 2.5 below). All Property Developers, Landlords, Property Management Agents, Designers and System Operators are welcome to apply for the use of fresh water for air-conditioning installations in their buildings within the designated areas. Applications for buildings not within the designated areas are also welcomed and will be considered on a case-by-case basis in consultation with WSD on adequacy of fresh water supply. Application shall be submitted together with the required information as stipulated in Paragraph 6 to the authorities concerned.

Participants shall comply with all relevant statutory regulations as well as minimum requirements as laid down in Part 2 for joining the Scheme. Besides, the participants are recommended to adopt the best practices related to the design, operation and maintenance of cooling towers as per the guidelines and recommendations given in relevant codes of practices.

All these requirements are set to achieve better energy efficiency, to protect the environment and to safeguard the public health and safety while using fresh water for evaporative cooling.

2.3 Conditions for Suspension or Cessation

Though the Scheme is aimed to be a standing scheme, it can still be suspended or ceased upon obtaining the endorsement from the Working Group (herein referred to Working Group mentioned in Paragraph 1) under the following conditions:

(a) Water rationing is implemented in the territory, or

(b) An outbreak of Legionnaires' disease in the territory, or

(c) Water resources are anticipated to be inadequate or water supply infrastructure cannot cope with the demand by water-cooled air conditioning systems.

If the Scheme is suspended or ceased under the above conditions, all new applications will not be processed. The water supply to the registered cooling tower installations will be subject to regulation by the Water Authority. The trade will normally be notified not less than 6 months in advance, unless the suspension or cessation should be executed immediately due to some severe situations.

2.4 Reviews

The conditions and requirements in the brochure for registration of cooling towers under the Scheme will be subject to review by the Interdepartmental Working Group of the Scheme so as to facilitate the promotion of the use of water-cooled air conditioning systems in Hong Kong.

2.5 Designated Areas

The designated areas for application for joining the Scheme are delineated in the latest location plans which can be downloaded at EMSD webpage: (http://www.emsd.gov.hk/emsd/eng/pee/psfwct_pub.shtml).

Part 2: Participation Procedures and Guidance

This part describes the statutory requirements, information required and processes involved with various government departments in the application for joining the Scheme for using fresh water for cooling towers for air conditioning systems.

3 Statutory Requirements

In general, the applicants shall ensure that their cooling towers comply with, but not limited to, the following Ordinances, Objectives, and Technical Memorandum:

- Waterworks Ordinance (WWO)(Cap. 102)
- Buildings Ordinance (BO)(Cap. 123)
- Sewage Services Ordinance (SSO)(Cap. 463)
- Water Pollution Control Ordinance (WPCO) (Cap. 358)
- Air Pollution Control Ordinance (APCO) (Cap. 311)
- Noise Control Ordinance (NCO) (Cap. 400)
- Occupational Safety and Health Ordinance (OSHO) (Cap. 509)
- Public Health and Municipal Services Ordinance (PHMSO) (Cap. 132)
- Technical Memorandum on Standards for Effluent Discharged into Drainage and Sewerage System, Inland and Coastal Waters
- Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites
- WSD's Water Quality Objectives of Sea Water for Flushing Supply (at Distribution)

Applicants are advised to check other relevant statutory requirements and seek the professional advice from a Licensed Plumber (LP), an Authorized Person (AP) and a Registered Professional Engineer (RPE) of building services or mechanical engineering discipline when they have queries in the procedures and the standard of works required.

4 Codes of Practice

Besides the above statutory requirements, the participants of the Scheme are required to adopt the best practices related to the design, operation and maintenance of cooling towers as per guidelines and recommendations given in the following codes of practice:

- Code of Practice for Prevention of Legionnaires' Disease 2007 (CoP(PLD))
- Code of Practice for Water-cooled Air Conditioning Systems (CoP(WACS)): Part 1, Part 2 and Part 3

5 Minimum Requirements for Registration under the Scheme

For registration of cooling tower installations under the Scheme, the participant shall meet the following minimum requirements for their cooling towers:

(a) Cooling towers shall be distant from:

(i) the surrounding air intakes and exhausts and operable windows, other than those stated in (ii) below, with minimum 7.5m horizontal separation in general [1];

(ii) for the cooling tower within 7.5m from its own building façade boundary, air intakes and exhausts and operable windows on its vertical building façade by minimum 7.5m below or 20m above; and

(iii) pedestrian thoroughfare and area of public access by minimum 7.5m [1].

(b) Cooling towers shall be provided with effective drift eliminators (with drift emission not more than 0.005% of maximum design water circulation rate) that minimize the formation and release of drift [2].

(c) Cooling towers shall be provided with effective water treatment equipment and bleed-off device to control bacterial growth. Bleed-off water from cooling towers shall be discharged to a flushing tank (via a break tank if applicable) and reused for flushing purpose [3] as far as practicable.

(d) Dead legs shall be minimized to avoid stagnant water as far as practicable in the cooling water circulation pipeworks for the cooling tower, and, where unavoidable, purge valves should be provided to the dead legs for regular draining.

1 Ref. CoP (WACS) Pt. 1 – s.4.1.3 and 4.1.4

2 Ref. CoP (WACS) Pt. 1 – s. 3.6

3 This arrangement is to minimize the burden of additional effluent to the sewerage systems.

(e) Cooling towers shall be provided with adequate and safe access to allow for the maintenance, inspection and water sampling required under the Scheme.

(f) Cooling towers shall be thoroughly cleaned, desludged and disinfected at least once every 6 months[4].

(g) Cooling towers shall be maintained to ensure that the cooling towers have (i) a Legionella Bacteria Count (LBC) that is below 10 cfu/ml, and (ii) a Heterotrophic Colony Count (HCC) that is below 100,000 cfu/ml[5]. The owners shall arrange for water sampling tests for the cooling towers (i) at least once every 3 months for LBC; and (ii) at least once a month for HCC.

(h) Risk management plan[6] (or water safety plan[7]) shall be provided for cooling towers systems to be installed at such facilities as stipulated in section 7 of the CoP(WACS): Part 1.

6 Information Required for Application

6.1 At the early design stage of new or replacement cooling tower installation, applicants may provide initial information as required in the application form (Form CT1A) for preliminary assessment and acceptance in principle of their application.

6.2 Before commencing the plumbing works for cooling tower(s) installation and applying to WSD for permission to proceed with the plumbing works, the applicants should submit a Notice of Commencement of Cooling Tower Installation Work (Form CT1B) together with other installation details in Form CT4.

4 Ref. CoP (WACS) Pt. 2 – s. 3.4.1
5 Ref. CoP (WACS) Pt. 2 – s. 2.5.3
6 Ref. s 7 of CoP(WACS): Pt 1
7 Ref. s 4.1 of CoP(PLD), 2007

7 Records Keeping during Operation

7.1 Records on operational conditions

Owners of completed cooling tower(s) installations should monitor, as well as, properly operate and maintain the condition and performance of their installations. They are required to keep records on the following information (via Form EMSD EE CT3) on monthly basis until the cooling towers are dismantled and put out of service:

(a) Condition of each cooling tower shell and its supporting framework;

(b) Daily operation time(s) and monthly sampling date;

(c) Energy consumption for all water-side equipment in monthly interval of the water-cooled air conditioning system(s);

(d) Total water consumption volume in monthly interval of the system(s);

(e) Total effluent discharge volume in monthly interval of the system(s);

(f) Quarterly sampling and testing of untreated and treated bleed-off water from the cooling tower installation by laboratory accredited under Hong Kong Laboratory Accreditation Scheme using accredited methods wherever applicable in respect of the following parameters[8]:

- Colour (H.U.),
- Turbidity (N.T.U.),
- Threshold Odour No.(T.O.N.),
- Ammoniacal N,
- Suspended Solids (SS),
- Dissolved Oxygen (DO),

8 The parameters, other than residual biocides / inhibitors, are monitored for meeting WSD's Water Quality Objectives of Sea Water for Flushing Supply (at Distribution)

- 5-Day Biochemical Oxygen Demand (BOD5),
- Synthetic Detergents,
- Residual biocides / inhibitors, and
- E. Coli / 100 mL(ECL).

(g) Monthly sampling and testing of the cooling water of the cooling tower installation in respect of the following parameters:

- Total dissolved solids (TDS),
- Conductivity,
- Calcium hardness,
- Total alkalinity,
- pH,
- Temperature,
- Residual biocide(s), and
- Residual corrosion/scale inhibiting chemical(s).

(h) Monthly sampling and testing of the cooling water of the cooling tower installation for Heterotrophic Colony Count (HCC);

(i) Quarterly sampling and testing (or whenever required by the approving authority such as after commissioning or major alteration) of cooling water of the cooling tower installation for Legionella Bacteria Count (comprising categories of Legionella pneumophila serogroup 1, Legionella pneumophila serogroup 2 to 14, and other species of Legionella) for validation of the effectiveness of the preventive measures against the growth of Legionella ; and

(j) Maintenance records of each cooling tower as stipulated in Section 7 of the Code of Practice for Prevention of Legionnaires' Disease 2007 and Appendix 2E of Part 2 of the Code of Practice for Water-cooled Air Conditioning Systems.

7.2 The owners shall make available such records for inspection by the EMSD's officers when requested.

7.3 Annual Audit Report

The owners shall commission an independent and competent auditor to conduct an annual audit for their cooling tower systems in accordance with Section 4.3 of Part 2 of the Code of Practice for Water-cooled Air Conditioning Systems. They shall submit the audit report on an annual basis before each year end to EMSD during the service life of the cooling tower systems.

7.4 Notification required during operation

7.4.1 Changes of Installation Details

The owners should notify EMSD, as soon as any key changes of installation details effected, with Form EMSD EE CT4.

7.4.2 Change of Ownership of Cooling Towers

When transfer of installation ownership occurs, the existing owners and new owners of approved cooling tower(s) installation shall complete the notification Form EMSD EE CT5 and submit to EMSD for update of records.

8 General Preamble

8.1 It is recommended that the applicants should appoint a Registered Professional Engineer of building services or mechanical engineering disciplines well in advance for advice in the proper design, installation, operation and maintenance of cooling towers.

8.2 Prior approval and consent shall be obtained from the Building Authority to construct the supporting framework for the cooling towers.

8.3 Any cooling tower should not be placed to protrude beyond the boundary of the lot.

8.4 In case cooling towers or their discharge outlets are proposed to be installed at podium floor and surrounded by existing proximate residential building blocks on the podium, the applicant should inform and/or consult the relevant residents association or alike, if any, about the proposed installation in the initial project design stage.

8.5 The bleed-off water from the cooling tower shall be discharged to the flushing tank, (via a break tank if applicable), and reused for flushing purpose. This arrangement is to minimize the burden of additional effluent to the sewerage systems.

8.6 Upon completion of the cooling tower installation, the owners should notify EMSD of the completion via Form EMSD EE CT2B (for completion of the installation in whole) or Form EMSD EE CT2A (for phased completion) as the case may be. The forms should be signed by a Registered Professional Engineer of building services or mechanical engineering discipline to certify that the cooling tower installation has been installed in accordance with the requirements stipulated in this Scheme brochure.

8.7 The owner should allow EMSD's authorized officers or representatives to enter the premises to inspect the cooling tower systems, and take water samples for testing if necessary for validation of operational conditions.

8.8 All forms can be downloaded at EMSD webpage: (http://www.emsd.gov.hk/emsd/eng/pee/psfwct_app.shtml).

9 Waterworks

9.1 Prior to any submission of proposal for new plumbing installations or alteration to existing plumbing installations for mains water supplies of cooling towers, the applicant shall obtain from the Water Authority (WA) such information which is relevant as to the design of the plumbing works. The applicant shall submit to WA the plumbing proposal and consumership undertaking by the Form WWO 542.

9.2 Upon receipt of the plumbing proposal to use mains water for cooling towers, the Water Authority will reply to the applicant in writing within 20 working days informing him whether such proposal is acceptable or not. Under normal circumstance, separate metering, thus separate water account, for this kind of supply is required. The applicant is reminded that a break tank for retaining bleed-off water from the cooling towers for reuse in internal flushing is normally required. The break tank shall be designed and constructed similar to that as stated in Clause 8.14 of the HK Waterworks Standard Requirements for Plumbing Installation in Buildings. Any subsequent alteration, revision and modification of the approved proposal should be submitted to the Water Authority for approval.

9.3 Prior to commencement of the plumbing works for mains water supplies of cooling towers shown on any approved plumbing proposal, the applicant shall submit to WA by Licensed Plumber the Form WWO 46 (Parts I and II). WA will return the Form WWO 46 (Part III) to the applicant for whether the permission to commence plumbing works is granted. The approval of providing metered water supply will not confer any legal implication on structural status of the cooling tower(s) nor carry any effect of precluding action being taken in respect of the structure by another authority. As the building works for the cooling tower(s) is under the jurisdiction of the Building Authority, it is premises owners' responsibility to obtain relevant consent from the Building Authority for these works. Failure to do so may result in removal of these cooling towers by the Building Authority.

9.4 Upon completion of the cooling tower installation, the owner should submit Form EMSD EE CT2B together with a site inspection report completed by an RPE to EMSD. EMSD will notify the applicant for whether the cooling tower installation is accepted under this Scheme. The applicant and the licensed plumber should apply to WA for inspection of plumbing work by the Form WWO 46 (Part IV). WA will notify the applicant by the Form WWO 46 (Part V) for whether the plumbing works up to make-up tank are completed satisfactorily. The applicant should ensure that all works other than waterworks are completed satisfactorily and acceptable to EMSD and the Building Authority. In case phased completion for cooling tower(s) installation is required, the applicant shall submit Form EMSD EE CT2A together with a site inspection report completed by an RPE to EMSD. EMSD will notify the applicant whether the phased completion of the cooling tower installation is accepted under this Scheme. The applicant should request the WA for water supply for phased completion. WA will arrange concessionary water supply to the cooling tower installation under phased completion provided that the plumbing works concerned are completed satisfactorily. The applicant should inform EMSD when the whole installation is completed.

10 Building Works

10.1 Any person intending to carry out building works such as supporting frameworks for cooling towers is required under the Buildings Ordinance to appoint an Authorised Person to prepare plans for the approval and consent of the Building Authority before the commencement of any works. Upon completion of the building works, the Authorised Person is required to certify that the building works have been carried out in accordance with the approved building plans.

10.2 It is strongly recommended that the advice of an Authorised Person should be sought well in advance. A directory of Authorised Person registered under the Buildings Ordinance is available in the Buildings Department for viewing.

10.3 Building works carried out without prior approval and consent from the Building Authority are unauthorized. The Building Authority may take enforcement actions under Sections 24 and 40 of the Buildings Ordinance to require the demolition of such building works; and/or to prosecute the offender in the court.

[Note: Alternative procedures for approval of minor works may be adopted under the Minor Works Control System (MWCS) which takes effect from 31.12.2010. Enquiries on MWCS can be made to the Buildings Department.]

11 Sewage Services Charge

11.1 According to the Sewage Services Ordinance, all water account holders whose premises are connected, whether directly or indirectly, to a communal drain or a communal sewer are liable to pay sewage charge (SC), except for water supplied specifically for flushing purposes. The water consumed by the WACS is subject to SC and the amount is calculated based on the prescribed SC rate multiplied by the total water consumption volume.

11.2 If the consumer or agent, as case may be, considers that the volume of wastewater being discharged to the public sewerage or drainage systems (including the volume of bleed-off water from cooling towers discharged to flushing tank) is not more than 85% of the total water consumption volume, the consumer can apply to the Drainage Authority for a reduction of SC based on a revision on the discharge factor. He will be required to provide information on the volumes of water consumed and wastewater discharged in his application. For the provision of such information, it will be preferable for the consumer or agent to install sub-meters to measure the volume of wastewater discharged at the terminal drainage outlet of the premises. If the consumer or agent has technical difficulties in installing these sub-meters, he should explain in his application on the situation and provide alternative information sufficient for the Drainage Authority to assess his application.

11.3 For the purpose of verifying the information that is needed in determining the factor to be charged for the SC, the Drainage Authority may, if deemed necessary, enter the premises of a consumer at all reasonable times for site inspection.

11.4 The information collected during handling of the application may be disclosed to other Government departments and their authorized agencies, if applicable, for law enforcement purposes should it be deemed necessary. Also, such information may be disclosed to the Electrical & Mechanical Services Department solely to facilitate their review of the requirements for the Scheme.

12 Water Pollution Control

All discharges containing polluting matter must be licensed under the Water Pollution Control Ordinance (WPCO). Any contravention to the WPCO will be subject to enforcement action. The standards for most likely contaminants are specified in the Technical Memorandum and the Environmental Protection Department will generally follow these. For biocides however the license standards need to be determined on a case by case basis. Prospective dischargers should provide the Environmental Protection Department with advance details of the biocides they intend to use and the proposed method of their application, the nature and location of the proposed discharge. The Environmental Protection Department will then specify conditions accordingly.

13 Air Pollution Control

The emissions, including water mist, from cooling towers would be actionable under the Air Pollution Control Ordinance (APCO) if the emission causes a nuisance and the Environmental Protection Department would issue an abatement notice where necessary. The most practical solution for tackling any tower fogging is to locate the tower where visible plume will not be objectionable.

14 Noise Control

Noise from any evaporative cooling towers is controlled under section 13 of the Noise Control Ordinance (NCO). Should the noise emanated therefrom exceed the relevant criteria stipulated in the "Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places

or Construction Sites", the Environmental Protection Department would issue a Noise Abatement Notice requiring the Noise Producer to rectify the problem and to comply with the statutory noise standard.

15 Nuisance Control

The emission of air or the discharge of water from cooling towers in any premises would be actionable under PHMSO if the emission causes a nuisance. The Authority would issue a Nuisance Notice to the nuisance producer to require him to abate the nuisance within the period specified in the notice, and the notice may, if the Authority thinks fit, specify any works to be executed for that purpose.

16 Occupational Safety and Health

Under the General Duties of OSHO, employers or occupiers must ensure that safety and health at work of all employees, for example by providing or maintaining a good work environment, and providing information, instruction, training and supervision to the employees. In the operation of air cooling plant unit for ventilation of a building, attention should be made to avoid or reduce any health risks arising from the associated work activities or the working environment, such as the risks of Legionnaires' diseases occurred among employees and over exposure to chemicals used for treatment of the cooling water. Good maintenance is important to avoid contamination of the ventilation system. Knowledge on handling chemicals could reduce health risks to minimal.

Part 3: Information for Enquiry and Application

17 Forms

The updated proforma forms of application and registration listed hereunder can be downloaded at EMSD webpage: (http://www.emsd.gov.hk/emsd/eng/pee/psfwct_app.shtml).

Form No.	Usage
EMSD EE CT1A	Application for Participation (Preliminary Assessment)
EMSD EE CT1B	Notice of Commencement of Cooling Tower Installation Work
EMSD EE CT2A	Notification of Phased Completion of Cooling Tower Installation
EMSD EE CT2B	Notification of Completion of Cooling Tower Installation(s)
EMSD EE CT3	Records of Operational Information
EMSD EE CT4	Cooling Tower Installation Details
EMSD EE CT5	Notification of Change of Ownership for Evaporative Cooling Tower Installation(s)

18 Process Charts

The latest process chart of application can be downloaded at EMSD webpage: (http://www.emsd.gov.hk/emsd/eng/pee/psfwct_app.shtml).

19 Enquiries

For more information about the Scheme, please contact the following departments during office hour for relevant information:

Electrical & Mechanical Services Department
(energy efficiency and cooling towers)
Energy Efficiency Office
7/F Electrical & Mechanical Services Department,
3 Kai Shing Street, Kowloon Bay,
Kowloon, Hong Kong.

Website: http://www.emsd.gov.hk
Email: info@emsd.gov.hk
Tel: 3757 6156
Tel: 1823
Fax: 2890 6081

Water Supplies Department
(water supply, conservation and charge)
Headquarters Office
43/F, Immigration Tower, 7 Gloucester Road,
Wan Chai, Hong Kong.

Website: http://www.wsd.gov.hk
Email: wsdinfo@wsd.gov.hk
Tel: 2824 5000
Fax: 2802 7333

Buildings Department
(building works and supporting frameworks for cooling towers)
12/F, Pioneer Building, 750 Nathan Road,
Mongkok, Kowloon.

Website: http://www.bd.gov.hk
Email: enquiry@bd.gov.hk
Tel: 2626 1616
Fax: 2537 4992

Environmental Protection Department
(air pollution control, noise pollution control, and water pollution control as well as sewage treatment and disposal of bleed-off water from cooling towers)
33/F, Revenue Tower, 5 Gloucester Road,
Wan Chai, Hong Kong.

Website: http://www.epd.gov.hk
Email: enquiry@epd.gov.hk
Tel/Fax: 2838 3111 (Customer Service Centre)

Drainage Services Department
(sewage services charge)
Customer Services Section
G/F, Western Magistracy,
2A Pok Fu Lam Road, Hong Kong

Website: http://www.dsd.gov.hk
Email: enquiry@dsd.gov.hk
Tel: 2834 9432
Fax: 2574 5645

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