Scheme for Wider Use of Fresh Water in Evaporative Cooling Towers for Energy-efficient Air Conditioning Systems

June 2008
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Scheme for Wider Use of Fresh Water in Evaporative
Cooling Towers for Energy-efficient Air Conditioning

Systems

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 bureaus 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 of the Pilot Scheme identified the growing trend of energy savings and associated application. The completion of fresh water cooling tower installations under the Pilot Scheme also confirmed that the Pilot Scheme and its established administrative framework have been effective and acceptable to developers, building owners and property management companies as a promising way to ascertain the energy efficiency in air conditioning systems for their new and existing non-domestic buildings. The policy bureaux concerned also have supported the conversion of the Pilot Scheme to a standing scheme with a view to facilitating the growing achievement of the energy saving goal without posing adverse impacts on the existing water supply and sewerage infrastructures.

The Pilot Scheme is converted to the standing scheme on 1 June 2008, and
renamed as “Scheme for Wider Use of Fresh Water in Evaporative Cooling Towers for Energy-efficient Air Conditioning Systems” (The Scheme). The existing regulatory and institutional framework of the Pilot Scheme is retained. The Scheme takes over the administration of existing applications and completed cooling tower installation(s) under the Pilot Scheme as well as all new applications. Some changes in operational and validation requirements as stipulated in Paragraphs 3 and 4.2 are imposed with a view to minimizing the risk of Legionnaires’ Disease associated with fresh water cooling towers, and upkeeping the quality of bleed-off water for flushing at distribution.

The designated areas are delineated in updated location plans of designated areas described in Paragraph 2.6, which can be downloaded from EMSD webpage (http://www.emsd.gov.hk/emsd/eng/pee/psfwct_pub.shtml). Experience gained, information and data collected from the Scheme will be used for assessing the implications of promoting evaporative cooling on a territory-wide basis.

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. 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 selected areas. Application shall be submitted together with the required information as stipulated in Paragraph 4.1 to the authorities concerned.

Throughout the Scheme, the participants of the Scheme shall provide the authorities concerned with the information required as stipulated in Paragraph 4.2.

Participants shall also comply with all relevant statutory regulations as well as requirements laid down for the Scheme. 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 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 Continuity of Water Supplies Connection

The participants is given continuous metered fresh water supplies by the authorities concerned provided that they continue to comply with the requirements stipulated in this brochure and the subsequent requirements that may arise from the Scheme reviews.

2.5 Reviews

The reviews of the Scheme will be conducted by the Working Group in order to analyse the effectiveness of the Scheme, to examine the pace and extent of participation and to formulate and update plans to promote water-cooled air conditioning systems in Hong Kong.
2.6 Location Plans of Designated Areas

The latest location plans of designated areas can be downloaded at EMSD webpage:

Part 2: Participation Procedures and Guidance

The objective of this part of the brochure is to give a general description on the statutory requirements, information required and processes involved with various government departments in application for using fresh water evaporative cooling towers for air conditioning systems in non-domestic premises located within the designated areas.

3. Statutory Requirements and Code of Practice

In general, the applicants shall comply with the following Ordinances, Objectives, Technical Memorandum and Code of Practices:

- 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
- Code of Practice for Prevention of Legionnaires’ Disease 2007
- Code of Practice for Water-cooled Air Conditioning Systems: Part 1, Part 2 and Part 3
• WSD’s Water Quality Objectives of Sea Water for Flushing Supply (at Distribution)

It is advised that applicants should 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. Information Required

4.1 Information Required for Application

Applicants shall provide the required information as laid down in the application form (EMSD EE CT1A) for processing and approving in principle their application.

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

The Form EMSD EE CT1A and Form EMSD EE CT1B for participation of the Scheme can be downloaded at EMSD webpage: (http://www.emsd.gov.hk/emsd/eng/pee/psfwct_app.shtml).
4.2 Information Required for Operation and Validation

Owners of approved and completed cooling tower(s) installations shall monitor, as well as, properly operate and maintain the condition and performance of their installations. They shall duly complete Form EMSD EE CT3 on monthly basis to provide the following information to the Electrical and Mechanical Services Department (EMSD) until the system(s) is/are dismantled and put(s) 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:

- Colour (H.U.),
- Turbidity (N.T.U.),
- Threshold Odour No.(T.O.N.),
- Ammoniacal N,
- 5-Day Biochemical Oxygen Demand (BOD$_5$),
- Suspended Solids (SS),
- Dissolved Oxygen (DO),
- Synthetic Detergents, 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 (COND),
- Calcium hardness (CaH),
- Total alkalinity (AKT),
- pH (pH),
- Temperature (T),
- Residual biocide(s) (RB(s)), and
- Residual corrosion/scale inhibiting chemical(s) (RIC(s));

(h) Monthly sampling and testing of the cooling water of the cooling tower installation in respect of the 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 in respect of Legionellae Count (comprising categories of Legionella pneumophila serogroup 1, Legionella pneumophila serogroup 2 to 14 and Legionella other species) for validation of the effectiveness of the preventive measures against the growth of Legionella; and

(j) Records of details of maintenance of each cooling tower as

In addition, the owners shall commission an independent and competent auditor to conduct the annual independent 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 and provide the audit report on annual basis before each year end to the Electrical and Mechanical Services Department (EMSD) throughout the service life of their cooling tower systems.

Besides, the owners shall notify EMSD, as soon as any changes of installation details effected, with Form EMSD EE CT4 as attachment of Form EMSD EE CT3.

The existing owners of approved cooling tower(s) installation are obliged to submit notification Form EMSD EE CT5A to EMSD when transferal of installation ownership incurs.

The new owners of previously approved cooling tower(s) installation shall also submit notification and undertaking Form EMSD EE CT5B to EMSD when taking over the installation from preceding owners for operation.

The above-mentioned forms can be downloaded at EMSD webpage: (http://www.emsd.gov.hk/emsd/eng/pee/psfwct_app.shtml).
5. **General Preamble**

5.1 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.

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

5.3 Any cooling tower shall not be placed to protrude beyond the boundary of the lot.

5.4 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.

5.5 Upon completion of the cooling tower installation, the owners shall submit Form EMSD EE CT2B (for certifying completion of the installation in whole and undertaking for the provision of operational information required under the Scheme) or Form EMSD EE CT2A (for reporting phased completion of the installation and applying for metered water supply on concessionary basis temporarily as well as undertaking for the responsibilities thereof) to EMSD. The forms shall be signed by a Registered Professional Engineer of building services or mechanical
engineering discipline to certify the cooling tower installation that has been installed in accordance with the requirements stipulated in this brochure and the owner to undertake to supply the operating information of the system and notify any changes of the installation. All forms can be downloaded at EMSD webpage: (http://www.emsd.gov.hk/emsd/eng/pee/psfwct_app.shtml).

5.6 The participant is required to supply the data required in Part 2, Paragraphs 4.1 and 4.2 of this brochure to the Electrical and Mechanical Services Department. If the participant has technical difficulties in providing such information, he shall explain and provide alternative information sufficient for the Authority to assess.

6. Waterworks

6.1. 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. Upon submitting Form EMSD EE CT1A in duplicate to EMSD (and a separate copy sent to the Buildings Department) and obtaining support from EMSD on the cooling tower installation, EMSD will notify WA and the applicant about the decision and the applicant shall submit to WA the plumbing proposal and consumership
undertaking by the Form WWO 542 and to EMSD the cooling tower(s) installation details by the Form EMSD EE CT1B.

6.2. Upon receipt of the plumbing proposal to use mains water for cooling towers, the Water Authority shall 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 may be required and any subsequent alteration, revision and modification of the approved proposal should be submitted to the Water Authority for approval.

6.3. Prior to applying permission to the commencement of the plumbing works for mains water supplies of cooling towers shown on any approved plumbing proposal, the applicant shall ensure that the Form EMSD EE CT1B has been submitted to EMSD (and a separate copy sent to the Buildings Department) and received reply that the cooling tower installation details are in order. The applicant shall then submit to WA the Permission to Commence Plumbing Works for Cooling Tower Installation by Licensed Plumber – the Form WWO 46 (Parts I and II). WA shall 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.

6.4. Upon completion of the cooling tower installation, the owner shall submit Form EMSD EE CT2B to EMSD. EMSD will carry out inspection to the cooling tower installation and notify WA and the applicant for whether the cooling tower installation is accepted. The applicant and the licensed plumber shall then apply to WA for inspection of plumbing work by the Form WWO 46 (Part IV). WA shall notify the applicant by the Form WWO 46 (Part V) for whether the plumbing works up to make-up tank are completed satisfactorily. Water supply will only be effected when other works are completed to the satisfaction of EMSD and the Building Authority. In case phased completion for cooling tower(s) installation is required, the applicant shall submit Form EMSD EE CT2A to EMSD requesting for water supply for phased completion. EMSD will also inspect the cooling tower installation and notify WA and the applicant by Part B of Form EMSD EE CT2A for whether phased completion of the cooling tower installation is accepted. WA shall then arrange concessionary water supply to the cooling tower installation under phased completion subject to the compliance by the owner for regular submission of the operational information of the cooling tower(s) installation. The applicant shall inform EMSD when the whole installation is completed.
7. **Building Works**

7.1. 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.

7.2. 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.

7.3. 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.

8. **Sewage Services**
8.1 The water consumed by the WACS will be subject to sewage charge (SC) and, where applicable, trade effluent surcharge (TES). The SC, at a prescribed rate currently of $1.2/m³ of water discharged, is levied on all water account holders whose premises are connected, whether directly or indirectly, to a communal drain or a communal sewer. As for the TES, it is levied on 30 prescribed trades and industries that produce effluents with sewage strength higher than that of domestic sewage. The rates of TES for the trades have been prescribed trades and industries that produce effluents with sewage strength higher than that of domestic sewage. The rates of TES for the trades have been prescribed in the Sewage Services (Trade Effluent Surcharge) Regulation. If separate water account has been registered against the water consumed for the cooling tower installation, only SC will be levied on this account. Otherwise, the rate of SC and TES applicable to the original trade, business or manufacture of the account will be levied on the total volume of water consumed under the account.

8.2 If the consumer or agent of the inside service of waterworks for mains water supplies of cooling towers considers that the volume of wastewater being discharged to the public sewerage or drainage systems is not more than 85% of the volume of water on which sewage charge and/or trade effluent surcharge is based, the consumer can apply for a revision to the sewage charges based on a revision on the discharge factor. He will be required to provide information on the volumes of water used and the final effluent 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 the final effluent 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.

8.3 For the purpose of verifying the information that is needed in
determining the rate to be charged for sewage charges and trade effluent
surcharges, the Drainage Authority may enter the premises of a
consumer at all reasonable times and leave equipment in a consumer’s
premises for measuring the volume of wastewater discharged, or
collecting samples of wastewater being discharged from cooling towers
into a communal sewer.

8.4 Any Application submitted to Drainage Authority and the verification
results obtained by Drainage Authority will be circulated to the
Electrical & Mechanical Services Department solely to facilitate the
review of the requirements for the Scheme.

9. **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.

10. Air Pollution Control

The emissions of 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.

11. Noise Control

Similar to other air conditioning systems or fixed noise sources, noise from any evaporative cooling towers is controlled under section 13 of the Noise Control Ordinance (NCO). The Environmental Protection Department will act on complaint and 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 Noise Control Authority would issue a Noise Abatement Notice requiring the Noise Producer to rectify the problem and to comply with the statutory noise
12. **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 abate the nuisance within the period specified in the notice.

13. **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

### 14. Forms

The updated proforma forms of application and registration listed hereunder can be downloaded at EMSD webpage:


<table>
<thead>
<tr>
<th>Form No.</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMSD EE CT1A</td>
<td>Application of Participation (Preliminary Assessment)</td>
</tr>
<tr>
<td>EMSD EE CT1B</td>
<td>Notice of Commencement of Cooling Tower Installation Work</td>
</tr>
<tr>
<td>EMSD EE CT2A</td>
<td>Application of Metered Water Supply on Concessionary Basis for Phased Completion</td>
</tr>
<tr>
<td>EMSD EE CT2B</td>
<td>Certification of Completion of Cooling Tower Installation(s)</td>
</tr>
<tr>
<td>EMSD EE CT3</td>
<td>Submission of Operational Information, and Notification of Change(s) of Cooling Tower Details</td>
</tr>
<tr>
<td>EMSD EE CT4</td>
<td>Cooling Tower Installation Details</td>
</tr>
<tr>
<td>EMSD EE CT5A</td>
<td>Notification of Change of Ownership for Evaporative Cooling Tower Installation(s)</td>
</tr>
<tr>
<td>EMSD EE CT5B</td>
<td>Notification of New Ownership for Evaporative Cooling Tower Installation(s)</td>
</tr>
</tbody>
</table>
15. Process Charts

The latest process chart of application can be downloaded at EMSD webpage:
16. 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 prevention of Legionnaires' Disease)
Website: [http://www.emsd.gov.hk](http://www.emsd.gov.hk)
Email: info@emsd.gov.hk

**Energy Efficiency Office**
7/F Electrical & Mechanical Services Department, 3 Kai Shing Street, Kowloon Bay, Kowloon, Hong Kong.
Tel: 2808 3465 (energy efficiency & conservation enquiries)
Tel: 1823 (citizen's easy link)
Fax: 2890 6081

**Water Supplies Department**
(water supply, conservation and charge)
Website: [http://www.wsd.gov.hk](http://www.wsd.gov.hk)
Email: wsdinfo@wsd.gov.hk

**Hong Kong & Outlying Islands Office**
611, King’s Road, North Point, Hong Kong.
Tel: 2880 2577
Fax: 2811 8152

**Kowloon Office**
2, Lai Hong Street, Cheung Sha Wan, Kowloon.
Tel: 2360 6123 or 2360 6122
Fax: 2390 6694

**New Territories Office**
128, Sai Yee Street, Mongkok, Kowloon.
Tel: 2399 4297
Fax: 2391 1490

**Headquarters Office**
43/F, Immigration Tower, 7 Gloucester Road, Wan Chai, Hong Kong.
Fax: 2802 7333

**Buildings Department**
(building works and supporting frameworks for cooling towers)
Website: [http://www.bd.gov.hk](http://www.bd.gov.hk)
Email: enquiry@bd.gov.hk

12/F, Pioneer Building, 750 Nathan Road, Mongkok, Kowloon.
Tel: 2626 1616
Fax: 2840 0451

**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)
Website: [http://www.epd.gov.hk](http://www.epd.gov.hk)
Email: enquiry@epd.gov.hk

10/F, Shatin Government Offices, 1 Sheung Wo Che Road, Sha Tin, New Territories.
Tel: 2838 3111 (general environmental protection enquiries)
Fax: 2838 2155

**Drainage Services Department**
(sewage charge and trade effluent surcharge)
Website: [http://www.dsd.gov.hk](http://www.dsd.gov.hk)
Email: enquiry@dsd.gov.hk

**Sewage Services Branch**
G/F, Western Magistracy, 2A Pok Fu Lam Road, Hong Kong
Tel: 2834 9575
Fax: 2832 9973
Energy Efficiency Office
Electrical and Mechanical Services Department
3 Kai Shing Street, Kowloon Bay, Kowloon, Hong Kong
電話 Tel: (852) 2808 3465 傳真 Fax: (852) 2890 6081
網址 Website: www.emsd.gov.hk
電郵 Email: info@emsd.gov.hk