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Panel on Development

Meeting on 23 November 2010

Background brief on enhanced control of fresh water cooling towers

Purpose

This paper provides background information on the control of use of fresh water towers and summarises the concerns and views previously expressed by Members on the subject.

Background

Water-cooled air-conditioning systems

2. Water-cooled air-conditioning systems (WACS) and air-cooled air-conditioning systems (AACS) are the two major types of central air-conditioning systems. WACS are more energy-efficient than AACS. A Preliminary Phase Consultancy Study for Wider Use of WACS in Hong Kong, commissioned by the Administration in October 1998, found that in quantitative terms, depending on the types of WACS to be used and the degree of conversation of AACS to WACS, the following results could be expected:

(a) savings of 7% to 10% air conditioning energy level used for non-domestic buildings by 2018, equivalent to 1,085 GWh to 1,666 GWh per year;

(b) deferment of 286 MW to 446 MW of new electricity generation capacity by 2018; and

(c) reducing greenhouse gas emission by 1.9% to 2.9% of 1990 inventory by 2018, equivalent to 600,000 tonnes to 940,000 tonnes of CO2 by 2018.

3. In February 2000, the Public Accounts Committee, after considering Chapter 2 of the Director of Audit's Report No. 33 of October 1999, recommended that the Administration should relax the ban on the use of mains water for air-conditioning, and facilitate the wider use of WACS in Hong Kong.

4. WACS may operate in the form of an evaporative cooling tower system using fresh water, or a direct cooling system using seawater.[1] The "Territory-wide Implementation Study for Water-cooled Air conditioning systems in Hong Kong", commissioned by the Administration and conducted from 2000 to 2003, recommended that use of fresh water, rather than seawater, for cooling towers was preferable due to the high corrosive effect of seawater and insufficient capacity of the existing seawater supply infrastructure.

Legislative control of use of fresh water for cooling towers

5. Pursuant to the Waterworks Regulations (Cap. 102 sub. leg. A), except with the permission in writing of the Water Authority, no person shall use water from waterworks[2] for cooling plant. To encourage the wider use of fresh water in WACS, evaporative type cooling towers are permitted to be used for industrial or essential purposes but seldom permitted for comfort air-conditioning in commercial buildings.

6. On 1 June 2000, the Administration launched a pilot scheme on the wider use of fresh water in WACS in designated areas. The Scheme, now named "the Scheme for Wider Use of Fresh Water in Evaporative Cooling Towers for Energy-efficient Air-conditioning Systems" (the FWCT Scheme),

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[1] This is also called the Cooling Tower Scheme. Other schemes for WACS include the District Cooling Scheme and the Central Seawater Scheme.

[2] Under section 2 of the Waterworks Ordinance (Cap. 102), the term "waterworks" means any property occupied, used or maintained by the Water Authority for the purpose of the Ordinance and any gathering ground.

is operating on standing status since 1 June 2008, also in designated areas.[3] Property developers, landlords, property management agents, designers and system operators can make an application with the Electrical and Mechanical Services Department (EMSD) for the use of fresh water cooling towers in the non-domestic buildings within designated areas. Under this Scheme, participants still need to seek written permission from the Water Authority for use of water from waterworks for the cooling towers.

Administrative control of fresh water cooling towers

7. Since September 2000, EMSD has been operating a voluntary registration scheme for fresh water cooling towers. EMSD conducted two cooling tower inspection programmes, from 2001 to 2005, and from 2006 to 2008 respectively, with a view to collecting information on and taking water samples from cooling towers throughout the territory to find out their operating conditions.

8. A set of Code of Practice for WACS was promulgated by EMSD in July 2006 to provide guidelines for the cooling tower design, installation, testing, commissioning, operation and maintenance with regard to the environment and health issues involved in the use of fresh water in WACS.

9. The installation and maintenance of cooling towers have been found to be associated with the spread of Legionnaires' Disease (LD). LD is an acute pneumonic illness caused by inhalation of aerosols contaminated with the Legionella bacteria dispersed from cooling towers or other water-using apparatus. All cooling tower installations under the FWCT Scheme are required to comply with the requirements stipulated in the Code of Practice for the Prevention of LD, which provides practical guidelines for building services practitioners and building owners on how to properly design, operate and maintain water apparatus, so as to reduce the risk of spreading the Legionella bacteria.

10. Participants of the FWCT Scheme are required to submit monthly returns[4] and annual independent examination reports to EMSD as evidence of compliance with scheme requirements.

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[3] As at April 2009, the FWCT Scheme covered 86 designated areas. Details about the designated areas can be found at the following hyperlink: http://www.emsd.gov.hk/emsd/eng/pee/psfwct_pub.shtml

[4] The monthly returns cover information about water test results, operating conditions of the cooling towers, energy consumption, water consumption and effluence discharge volume, etc.

Previous discussions by Members

11. From 2000 to 2003, there were discussions about the use of fresh water in WACS at the Panel on Environmental Affairs and the Finance Committee when the Administration sought the latter's approval for funds for commissioning consultancy studies on the subject and reported the results of the studies. In general, members supported the early implementation of wider use of fresh water in WACS because it promoted more efficient use of energy. Some members expressed the following views that:

(a) proper maintenance of water cooling towers was necessary to prevent LD; and

(b) the Administration should speed up the demolition of dangerous and illegal cooling towers structures and carry out periodic inspections to ensure the safety of such towers.

12. At the Council meeting on 2 May 2007, while responding to a Member's oral question about LD, the Administration informed the Council that among 10,057 water samples collected under EMSD's cooling tower inspection programme from 2001 to 2005, 892 samples had been detected with Legionella bacteria concentration exceeding the acceptable level of 1,000 colony forming units per millilitre. The cooling towers in question were cleansed and disinfected immediately. EMSD notified persons-in-charge of the concerned cooling towers to pay attention to the operation and maintenance of the towers. Some Members queried the lack of legislative measures to control the spread of Legionella bacteria in cooling towers. The Administration responded that reported cases of LD were sporadic, which made it difficult to confirm the sources of infection, therefore it had no plan to enact legislation that required the owners of cooling towers to cleanse and disinfect the facilities regularly. Insofar as the control of LD was concerned, the Administration relied on the self-regulation of professionals in the maintenance and operation of WACS, accompanied by regulation via the relevant Codes of Practice.

Latest development

13. The Audit Commission (Audit) has conducted recently a study of the Administration's efforts and progress in promoting the wider use of WACS. In

the Report No. 53 of the Director of Audit, published on 25 November 2009, Audit made the following recommendations, among others, regarding the use of fresh water in WACS:

(a) Need for sustained efforts to promote the wider use of WACS

While the FWCT Scheme covered over 75% of the total non-domestic gross floor area (GFA) in Hong Kong, only11% of the non-domestic GFA had joined the Scheme.

(b) Need to extend the coverage of the FWCT Scheme

As at April 2009, about 25% of the non-domestic GFA in the territory was not yet covered under the Scheme and only 14% of the non-domestic GFA in the designated areas had joined the Scheme.

(c) Need to encourage conversion of AACS to WACS

As at April 2009, 97% of the new non-domestic buildings (in terms of GFA) in designated areas had joined the FWCT Scheme to install WACS. However, only 5% of the existing buildings (in terms of GFA) had joined the Scheme to replace their AACS with WACS.

(d) Need to ensure compliance with scheme requirements

Audit examination of 30 WACS installations under the FWCT Scheme revealed that most of the scheme participants did not fully comply with the requirements of submitting monthly returns and annual independent examination reports to EMSD.

(e) Need to review the use of cooling towers in hospitals

In 2004 and 2006, the Architectural Services Department conducted reviews and concluded that WACS with cooling towers should not be used in acute or infectious disease hospitals so as to prevent the spreading of infectious diseases. Audit noted that there were cases where such towers were installed in a number of public and private hospitals.

(f) Need to closely monitor the increasing trend in LD cases

In Hong Kong, sporadic cases of LD have been reported without any outbreak. However, there has been an increasing trend of LD cases in recent years since 2005, notably in 2009.

(g) Need to note the impact of contaminated aerosols on public health

In addition to LD, the Legionella bacteria may induce Pontiac fever, a self-healing illness with flu-like symptoms. Audit notes that Pontiac fever has a high infection rate but it is not adequately mentioned in published guidelines for prevention of LD.

(h) Need to prioritise and conduct more inspections of cooling towers

In 2005, EMSD completed the first round of inspections covering 8,387 cooling towers, but was unable to inspect all the known cooling towers. The inspection programme from 2006 to 2008 was also substantially reduced in scale.

(i) Need to strengthen controls over installation and maintenance of cooling towers

For cooling towers detected with Legionella bacteria in the water samples collected, EMSD would request the owners to take necessary remedial actions. Audit noted that in many cases the owners did not respond to the EMSD's instructions.

(j) Need to control contamination of cooling towers under the FWCT Scheme

EMSD's inspections from 2001 to 2008 found that some cooling towers under the Scheme, including some installed in 10 government premises, were contaminated.

(k) Need to review the presentation of cooling tower water quality test results

The cooling water quality criterion for Legionella bacteria adopted by the EMSD was 10 cfu/ml. A Legionella bacteria count of over 1,000 cfu/ml was considered a high contamination level calling for emergency decontamination. The Administration should, in reporting test results for Legionella bacteria in water samples in future, consider providing information on contamination cases with a Legionella bacteria count of 10 cfu/ml or more, apart from those over 1,000 cfu/ml.

(l) Need to review effectiveness of voluntary compliance measures

In September 2000, EMSD launched the Voluntary Registration Scheme for Cooling Towers (VRS). In November 2006, EMSD issued 8,000 letters to owners of unauthorised cooling towers inviting them to join the FWCT Scheme. Despite EMSD's invitations, as at September 2009, there were only 61 cooling towers in 18 premises (out of about 10,000 unauthorised cooling towers) registered under the VRS. As for the FWCT Scheme, EMSD had only received 15 applications.

(m) Need to ensure no unauthorised cooling towers in government buildings

Two fresh water cooling towers were installed in the Civil Engineering and Development Building in Ho Man Tin for air-conditioning purposes. According to the WSD, it had no records of approving the use of mains water for air-conditioning purposes in this Government building.

(n) Need to identify target groups of cooling towers for further action

Audit noted that some unauthorised cooling towers were located in: (i) shopping centres of housing estates; (ii) premises owned by major property developers; (iii) premises managed by major

property management agents; and (iv) premises operated by reputable chain stores and restaurant groups. EMSD should encourage the owners of these towers to join either the FWCT Scheme or the VRS.

14. The Director of Audit has reported that the Administration agreed to Audit's recommendations.

15. The Administration will brief the Panel on Development the measures to enhance the control of fresh water cooling towers at the meeting on 23 November 2010.

References

16**.** A list of relevant papers with their hyperlinks is in the **Appendix**.

Council Business Division 1
Legislative Council Secretariat
17 November 2010

Appendix

Enhanced control of fresh water cooling towers

List of relevant papers

Council/Committee	Date of meeting	Paper
Public Accounts Committee	10 December 1999	Public Accounts Committee Report No. 33 (Chapter 2) http://www.legco.gov.hk/yr99-00/english/pac/report/pac-r33.pdf
Panel on Environmental Affairs	10 February 2000	Discussion paper (LC Paper No. CB(2)1020/99-00(03)) http://www.legco.gov.hk/yr99-00/english/panels/ea/papers/1020e03.pdf Minutes http://www.legco.gov.hk/yr99-00/english/panels/ea/minutes/ea100200.pdf
Panel on Environmental Affairs	2 March 2000	Discussion paper (LC Paper No. CB(2)1232/99-00(06)) http://www.legco.gov.hk/yr99-00/english/panels/ea/papers/1232e06.pdf Minutes http://www.legco.gov.hk/yr99-00/english/panels/ea/minutes/ea020300.pdf
Finance Committee	28 April 2000	Discussion paper (LC Paper No. FCR(2000-01)2) http://www.legco.gov.hk/yr99-00/english/fc/fc/papers/f00-02e.pdf Minutes http://www.legco.gov.hk/yr99-00/english/fc/fc/minutes/fc280400.pdf

Council/Committee	Date of meeting	Paper
Panel on Environmental Affairs	22 July 2003	Discussion paper (LC Paper No. CB(1)2231/02-03(03)) http://www.legco.gov.hk/yr02-03/english/panels/ea/papers/ea0722cb1-2231-3-e.pdf Minutes http://www.legco.gov.hk/yr02-03/english/panels/ea/minutes/ea030722.pdf
Legislative Council	2 May 2007	Official Records of Proceedings http://www.legco.gov.hk/yr06-07/english/counmtg/hansard/cm0502-translate-e.pdf
Report No. 53 of the Director of Audit (published on 25 November 2009)	-	Summary (Chapter 11) http://www.aud.gov.hk/pdf_e/e53ch11sum.pdf