Survey on Disinfection Practices in Other Coastal Cities

Overview

A survey on the disinfection practices in other coastal cities was conducted under the "Harbour Area Treatment Scheme - Environmental Impact Assessment Study for the Provision of Disinfection Facilities at Stonecutters Island Sewage Treatment Works". The purpose of the survey is to understand the current practices and the trend of disinfection technologies in other coastal cities with similar marine discharge conditions as HATS. Information gathered from the survey was used as reference in evaluating disinfection options for HATS.

2. A total of 24 coastal cities were selected for the survey, including eight in North America, nine in Asia/Australia/New Zealand and seven in Europe, as listed below. 132 sewage treatment works, each with a design capacity of not less than 10,000 m^3/day, were identified in the 24 surveyed cities. The total flow capacity of the 132 sewage treatment works is 36.7 million m^3/day.

North America (8 cities)	Europe (7 cities)	Asia/Australia/New Zealand (9 cities)
- Vancouver, Canada	- Bremen/Bremerhaven, Germany	- Auckland, New Zealand
- Halifax, Canada	- Hamburg, Germany	- Bangkok, Thailand
- Boston, USA	- Cardiff, Wales	- Guangzhou, China
- Honolulu, USA	- Swansea, Wales	- Shanghai, China
- Los Angeles, USA	- Dublin, Ireland	- Kaohsiung, Taiwan
- Miami, USA	- Edinburgh, Scotland	- Melbourne, Australia
- New York, USA	- London, England	- Sydney, Australia
- Seattle, USA		- Singapore
		- Tokyo, Japan

Current Disinfection Practices in Surveyed Cities

3. 13 of the surveyed sewage treatment works are primary/chemical enhanced primary treatment works with a total flow capacity of 6,762,000 m^3/day. 69.4% of the effluent is discharged to receiving waters without disinfection. Chlorination is used to disinfect 30.3% of the effluent. The capacity of the largest primary treatment plant is 1,173,000 m^3/d in Newtown Creek, New York, USA (currently being upgraded to secondary treatment). One small chemically enhanced primary treatment plant, Bellambi STW in Sydney, Australia, with a capacity of 24,000 m^3/d, is disinfected by UV radiation.

4. The remaining 119 plants are secondary/tertiary sewage treatment works contributing a total flow capacity of 31,926,000 m^3/day. 29% of the secondary/ tertiary effluent is discharged to receiving waters without disinfection.

Chlorination is used to disinfect 65% of the secondary/tertiary effluent. The capacity of the largest secondary plant using chlorination is 1,817,000 m^3/d in Deer Island, Boston, USA (was previously a primary treatment works with chlorination for disinfection before upgrading to a secondary treatment in plant in 1999). UV radiation is used to disinfect 5% of the secondary/tertiary effluent. The capacity of the largest secondary plant using UV radiation is 638,000 m^3/d in Ringsend, Dublin, Ireland.

5. Based on the survey results, chlorination/dechlorination is the most commonly used disinfection technology in these cities, treating some 67% of the effluent. UV radiation only accounts for about 3% and the remaining 30% receives no disinfection before discharge. Other disinfection technologies are rarely used.

Disinfection Practices in Large STWs

6. Of the 132 sewage treatment works surveyed, there are 75 sewage treatment works each with a design capacity of not less than 100,000 m^3/day. 36% of the effluent from these large STWs is discharged to receiving waters without disinfection. Chlorination is used to disinfect about 60% of the effluent. UV disinfection is used to disinfect about 4% of the effluent. Table 1 shows a summary of the disinfection practices in large STWs.

Table 1 – Summary of Disinfection Practices in Large STWs (>100,000 m^3/d)

	Total	Chlorination	UV Radiation	Other Technologies	No Disinfection
No of STWs	75	44	4	1	26
Total Flow Capacity (m^3/d)	36,583,000	21,725,000	1,263,000	273,000	13,322,000
% (flow)	100	59.4	3.5	0.7	36.4

Trend in Disinfection Technologies

7. Of the disinfection facilities commissioned in the surveyed cities in the last 10 years, some 75% of the installed capacities use chlorination/dechlorination, whilst the remaining 25% use UV radiation for disinfecting mostly secondary or tertiary effluents. For those facilities to be commissioned in the coming five years, the total flow capacity of the new UV radiation installations is similar with that of new chlorination facilities.

8. Most of the UV facilities installed/to be installed are used to disinfect secondary/tertiary effluents. The application of UV radiation in primary effluents is rarely adopted. Examples of some large UV radiation facilities recently commissioned/to be commissioned include:

- the Ringsend STW in Dublin, Ireland – commissioned in 2003 with a flow capacity of 638,000 m^3/day;
- the Megere STW in Auckland, New Zealand – commissioned in 2003 with a flow capacity of 300,000 m^3/day, and
- the Longhua STW in Shanghai, China – commissioned in 2003 with a total flow capacity of 105,000 m^3/day.

9. As for chlorination, notable new installations include:

- the South STW in Seattle, US – commissioned in 2002 with a flow capacity of 435,000 m^3/day;
- the Da Tan Sha STW and Lie De STW in Guangzhou – commissioned in 2004 with a total capacity of 1,020,000m^3/day; and
- the Annacis Island STW in Vancouver, Canada – being planned to replace its gaseous chlorination disinfection facility by sodium hypochlorite and sodium bisulphite, with a flow capacity of 483,000 m^3/day.

10. Based on the information gathered from the survey, the reason for the increasing use of UV radiation for disinfection of secondary/tertiary effluents is mainly due to its technological advancements in recent years resulting in its becoming more cost-competitive. However, its application in primary effluents is less cost-effective due to the low UV transmittance and hence the need for a large number of UV lamps in such applications. It should be noted that both UV radiation and chlorination/dechlorination are environmentally acceptable disinfection technologies. Whilst chlorination/dechlorination would attract environmental concerns, UV radiation would also have environmental issues, like disposal of large quantity of mercury lamps and high energy consumption, that need to be addressed.

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