

Harbour Area Treatment Scheme Stage 2



HKIE / CIWEM Meeting
9 November 2004

Chlorination / Dechlorination Disinfection



HATS Stage 1

Before –

sewage spread through the Victoria Harbour, including the Ramblers Channel

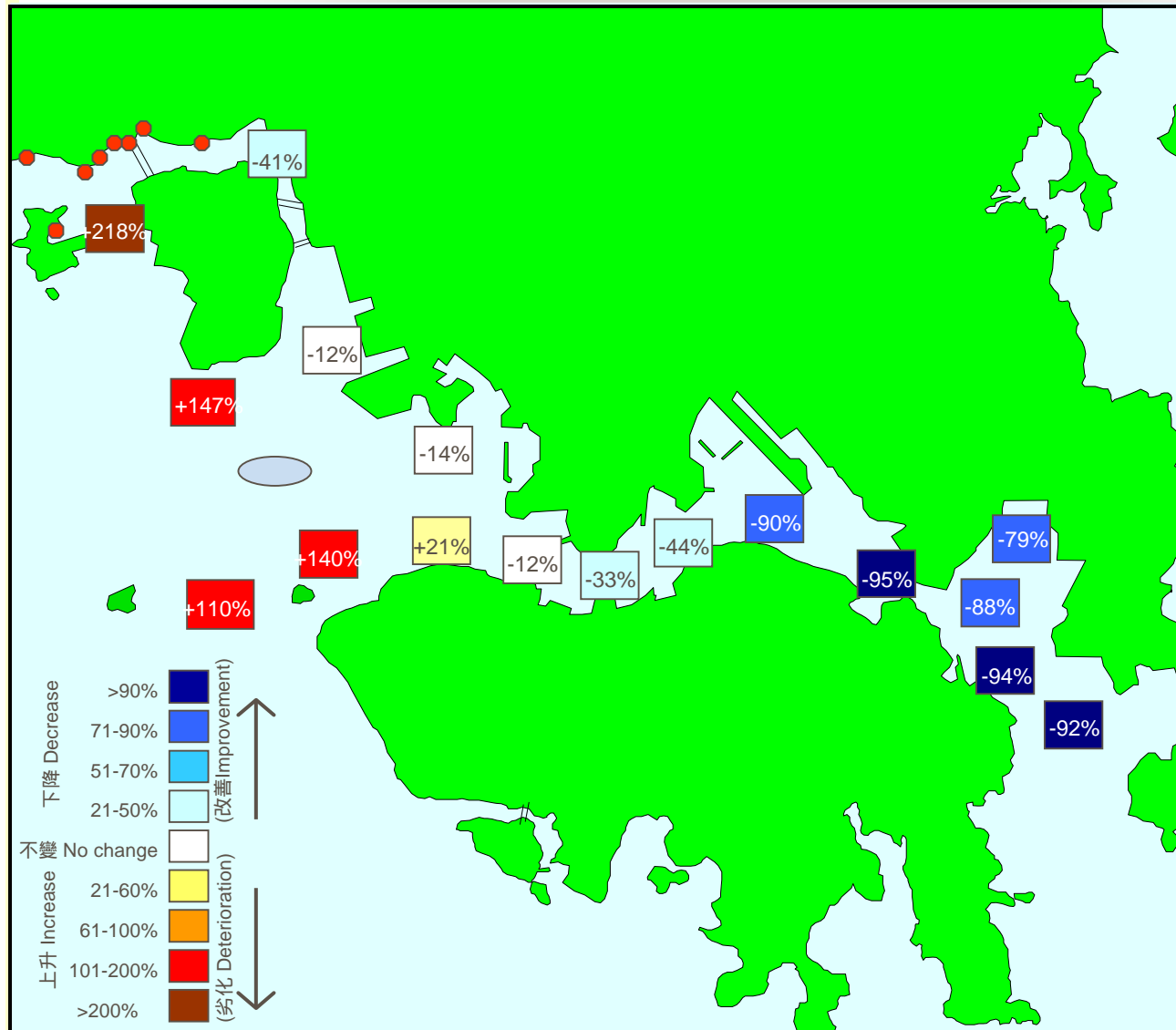


After –

sewage treated at Stonecutters Island and discharged in the western anchorage area



E.coli



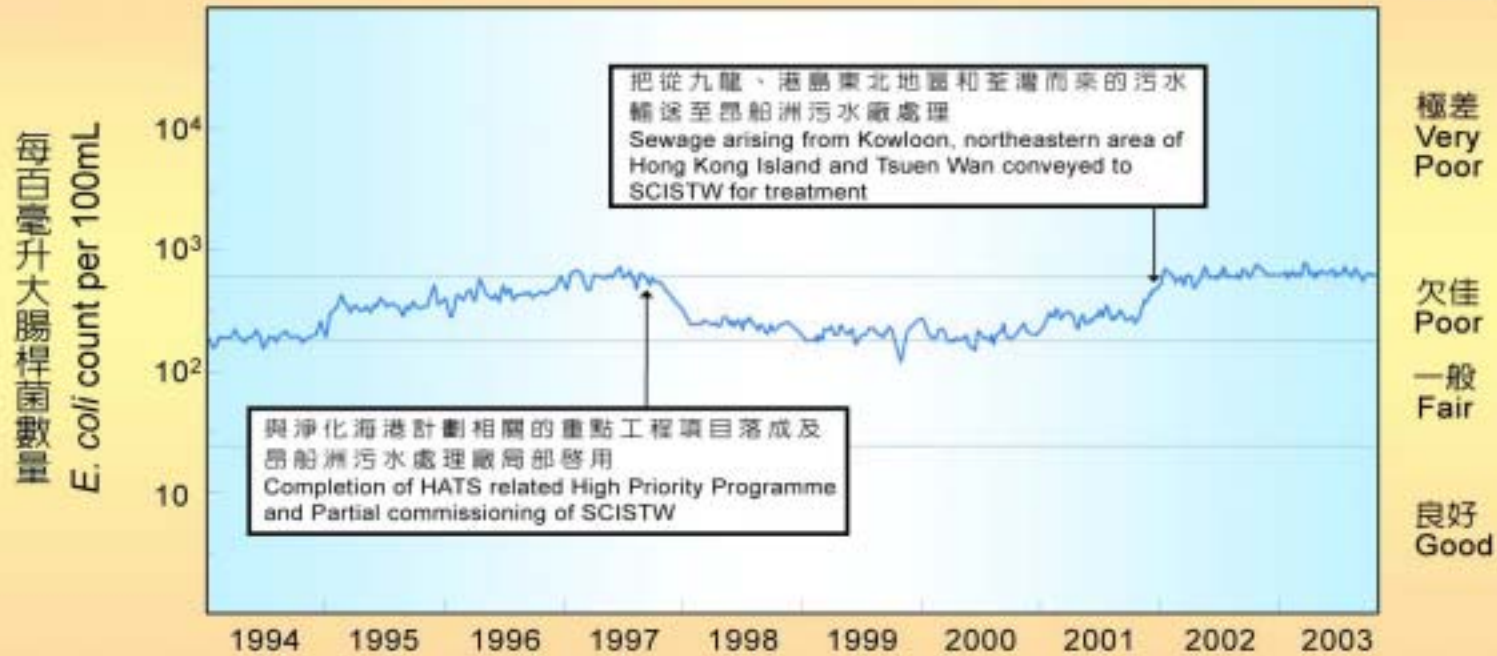
Map showing improvement / deterioration in *E.coli* bacteria at 17 stations (comparison of mean difference between (Jan 2000 – Dec 2001) and (Jan 2002 – Dec 2003))

The Need for Disinfection

Total Attendance Rate
at Tsuen Wan Beaches = 80,000

麗都灣
Lido

水質
Water
Quality



Rank	<i>E.coli</i> per 100 mL	Minor illness rate (cases per 1000 swimmers)
Good	≤ 24	Undetectable
Fair	25 – 180	≤ 10
Poor	180 – 610	11 – 15
Very Poor	> 610	> 15

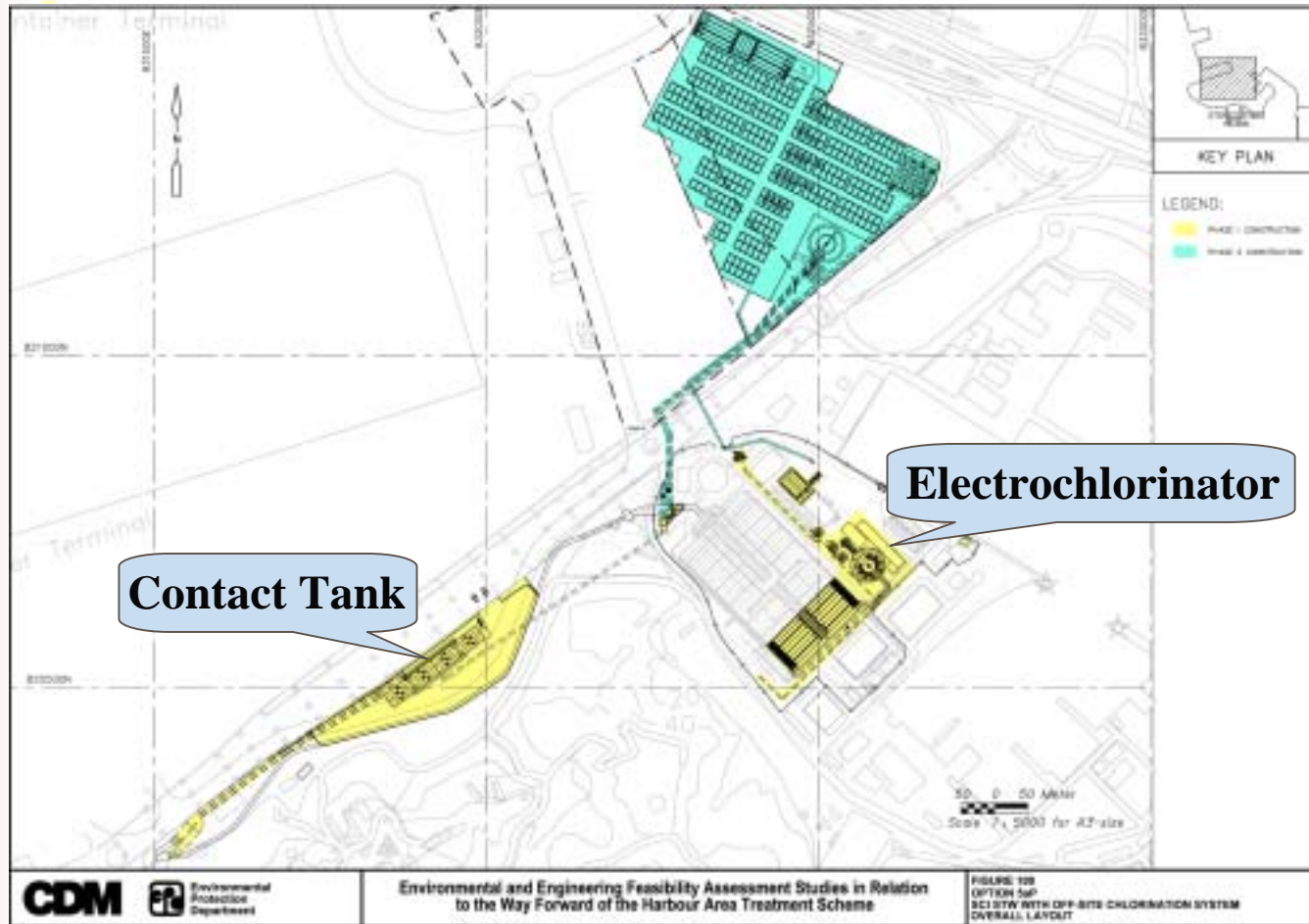
The Need for Disinfection

- Raw sewage contain 2,600,000 *E.coli* per 100 mL.
- CEPT removes 50% of *E.coli*
- Tsuen Wan DC and LegCo PAC had urged for disinfection

Sewage Treatment Works	<i>E.coli</i> per 100 mL Monthly Geomean	<i>E.coli</i> per 100 mL Geomean
Shatin STW Biological Treatment	42,000 – 710,000	110,000
Cyberport STW CEPT + UV Disinfection	1,400 – 17,000	4,300

- Model results indicated that biological treatment can ensure the Tsuen Wan beaches meet the bathing water quality requirement on an average basis.
- But there are times when the *E.coli* level at beaches is high due to tidal movement.

Chlorination / Dechlorination at SCISTW



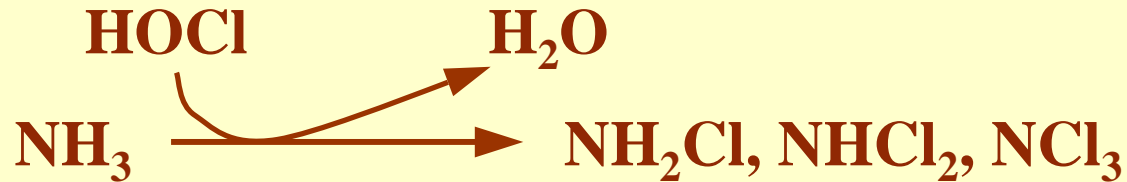
- Average chlorine dosage rate is 15 mg/L
- Average contact time is 30 minute

Ecological Impact by Chlorination

- Literature Review on Toxicity Tests :
 - Zillich (1972) and Brungs (1973) - thiosulphate addition to chlorinated effluent would significantly reduce effluent toxicity.
 - Sepp (1981) – using flow-through fish bioassay at 3 STWs, slight sulphur dioxide overdose would completely remove all chlorination-induced toxicity. Excess sulphur dioxide residual appeared non-toxic to test-fish.
 - Paller et al. (1983) - TRC was the main toxicant on fish in streams receiving chlorinated secondary effluent.
 - Blatchley III et al. (1996) - chlorination and dechlorination would not induce toxicity on secondary treated domestic wastewater.
 - Drury et al. (1997) - by switching the effluent TRC from 0.1 mg/L to 0.05 mg/L, the toxicity observed at 3 STWs was completely removed.
- Toxicity Tests using local marine species will be conducted under the detailed EIA Study

Chlorinated-By-Products

- Ammonia in effluent will react with free chlorine to form chloramines



- As chloramines have lower oxidation power as compared with free chlorine, formation of chloramines will suppress the formation of chlorinated by-products (CBP). The CBP level meets the drinking water requirement

	WHO Drinking Water Standard	Effluent Conc.
■ THM	0.05 – 0.2 mg/L	~ 0.03 mg/L
■ HAA	0.05 – 0.1 mg/L	~ 0.1 mg/L
■ Both THM and HAA are not bioaccumulative		

- Literature review also indicates that chlorination for primary treated effluent contains less chlorinated organic by-products than secondary treated effluent.

International Experience on Disinfection

We have searched some 150 sewage treatment plant through the internet. Below is the summary of disinfection facilities.

Country	Disinfection Technique				Total
	Chlorination	UV	Chlorination + UV	Nil	
Australia	1	5	1		7
Canada	9	3	2	3	17
US	81	22	2	13	118
Germany				7	7
UK				2	2
Spain		1		1	2
Total	91	31	5	26	153

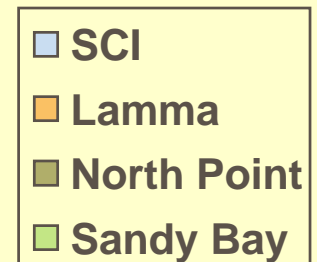
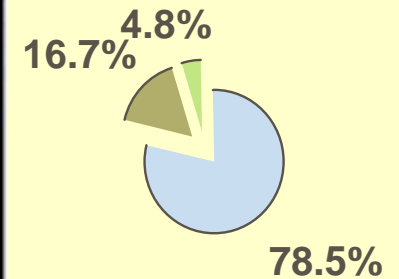
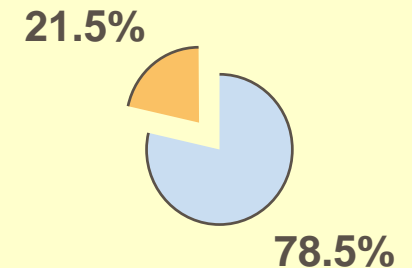
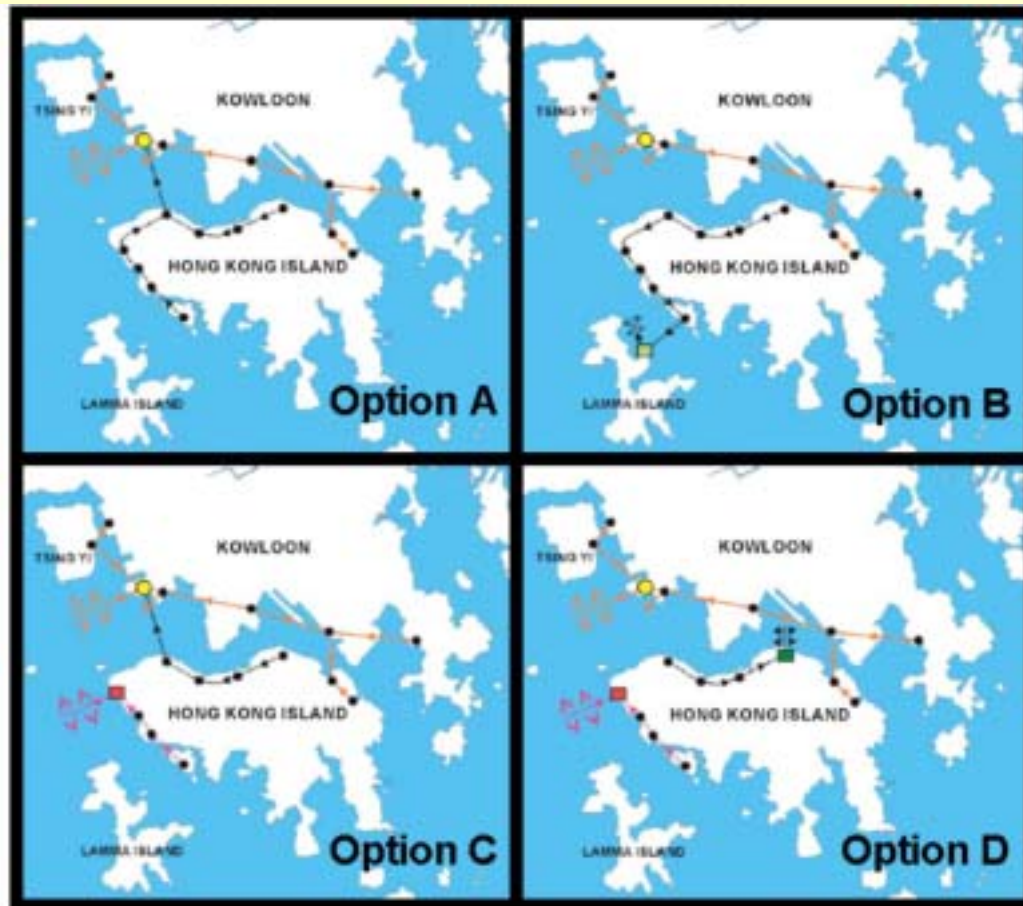
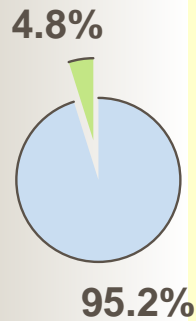
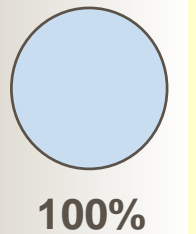
- Over 500 sewage treatment plants in US use chlorination and dechlorination for wastewater disinfection -- WPCF Disinfection Committee 1987
- Chlorination is still an acceptable disinfection option for production of reclaimed water in California

Centralization vs Decentralization Options



HATS – Sewage Flow Distribution

(Potential operational risk Vs Not-in-my-backyard)



International Experience in Centralization

Montreal, Canada – with a deep tunnel system of 89.5 km and a single CEPT with an average flow of 2.5 million cu.m./day



International Experience in Centralization

Helsinki, Finland – Helsinki had once operated 11 STWs which were replaced by a centralized treatment system in 1995. The Viikinmaki STW is now providing treatment for 800,000 population from Helsinki, Sipoo, Kerava, Tuusula and Järvenpää and Vantaa.



The Viikinmaki Sewage Treatment Works

International Experience in Centralization

Singapore – 60 km deep tunnel system being built to two centralized sewage treatment works to replace the existing six sewage treatment works system



Stonecutters Island



Lamma Island



Sandy Bay



View of Sandy Bay Hillside



North Point



View of North Point STW Hillside

Technologies for Biological Treatment



BAF Trial (生物曝氣濾池)

- BAF can meet the effluent requirement but require very skillful operator and reliable on-line monitoring system
- SAF is not able to meet our requirement



- We have presented all results to the MG during our discussions and the reports are available in our website.



Treatment Technology

Government's initial thinking on biological treatment technology

- Will not specify treatment technology
- Performance specification to be used
- Land requirements, operational risk, reliability, cost-effectiveness, proven track record in large scale applications are issues to be considered in the selection process

Harbour Area Treatment Scheme



www.cleanharbour.gov.hk