

Workshop on Editorial Management for Senior
Women Journalists : April 20-27, 1994, Singapore :
[field trip background]

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Field Trip Background

KEEPING SINGAPORE CLEAN

1 INTRODUCTION

1.1 Singapore is a tropical island of 625 sq km and has a population of over 3 million people. Its hot and humid climate with high annual rainfall provides ideal ecological conditions for rapid bacterial growth, organic decomposition and the propagation of disease-bearing insects. The country's densely populated community favours disease transmission. Under these conditions, rapid urbanisation and industrialisation may create serious health hazards if environmental pollution is not properly controlled.

1.2 The need to prevent pollution and create a clean environment was recognised in the mid 1960's. In 1967, a Plan of Action was drawn up to transform Singapore into a clean city. The Plan comprised 3 main elements, namely :

- a) Public awareness campaign
- b) Re-organisation of the Environmental Health Department
- c) Updating of outdated public health laws.

1.3 The objective of this Plan was declared a matter of national priority second only to defence and economic development. The Ministry of Health, then responsible for environmental health and street cleansing, was given the responsibility of implementing the Plan.

2 PUBLIC AWARENESS CAMPAIGN

2.1 The mainstay of the Plan was a month-long campaign known as the "Keep Singapore Clean" campaign. This was launched in October 1968 to educate every Singaporean on the importance of not littering the streets, drains and public places.

2.2 The Campaign committee which was formed to run the Campaign was headed by the Minister for Health and comprised representatives from Civic Organisations, Trade Unions, Chamber of Commerce and Government Organisations. The participation of government, civic and private organisations gave the Campaign a national character.

2.3 The following are the main activities that were implemented.

- a) Educational exhibitions were held at public places.
- b) A wide variety of publicity materials were distributed eg posters, leaflets, car-stickers and banners.
- c) The press, radio and television gave extensive coverage and publicity. Cinema slides were also screened.
- d) Educational talks and film shows were organised by the participating organisations for their staff.
- e) Competitions to pick the cleanest premises were organised by participating organisations.
- f) Members of Parliament together with community leaders organised educational activities at the constituency level and made house-to-house visits to educate residents and spread the message of keeping Singapore clean.
- g) The Police and the public health inspectorate staff went on patrol to advise the public against littering.
- h) The number of litter bins placed along streets and in public places were increased and these were emptied daily. "No littering" signs were also placed at conspicuous points to remind the public not to litter.

2.4 After the month-long campaign, enforcement actions were taken against recalcitrant offenders. Litterbugs were "ticketed" on the spot and asked to go to court to answer the charge.

2.5 In the years after 1968, "Keep Clean" campaigns were repeated along similar lines but with an additional theme each year, eg:

- 1969 - Keep Singapore Clean and Mosquito Free
- 1970 - Keep Singapore Clean and Pollution Free
- 1971 - Keep Singapore Pollution Free
- 1973 - Keep Our Water Clean

2.6 In subsequent years, campaigns were organised on a smaller scale and targeted at specific groups. Messages encouraging the public to use plastics bags to dispose of their refuse properly were also incorporated.

3 REORGANISATION OF THE ENVIRONMENTAL HEALTH DEPARTMENT

3.1 Before the 1968 campaign was implemented, the Environmental Health Department, then responsible for refuse collection and street cleansing, was reorganised. The aim of the reorganisation was to improve efficiency by establishing a clean chain of command amongst supervisory staff and by defining their responsibilities more clearly.

3.2 A seven-day working week was also introduced whereby streets were swept and refuse removed every day of the week including Sundays and public holidays. Labour laws were amended to allow cleansing workers to work on a Sunday or public holiday and be given a day off on any other day in lieu of pay for work on a Sunday or public holiday.

3.3 An Operations Room was set up at the headquarters of the Environmental Health Department to monitor the efficiency of refuse collection and cleansing operations throughout the island. Complaints received from the public on environmental health matters were also monitored.

4 UPDATING OF OUTDATED PUBLIC HEALTH LAWS

4.1 Another important measure taken before the 1968 Campaign was the updating of outdated public health laws and the enactment of new laws. Among the new provisions in the Environmental Public Health Act, 1968, was a clause requiring every householder to provide adequate receptacles for their refuse. Another new provision was the provision for "ticketing" littering offenders to court. A first time offender could be fined up to *\$500.00 (* the amount was increased to \$1000.00 in 1987), and second or subsequent offenders up to \$2000.00. The new provisions were publicised and explained during the "Keep Singapore Clean" Campaign.

4.2 In 1992, the Corrective Work Order or "CWO" was introduced. Under the Order, recalcitrant "littering offenders" will be sentenced to clean a public place, instead of a fine. This will give them an insight into the massive efforts put in to keep Singapore clean.

5 FORMATION OF THE MINISTRY OF THE ENVIRONMENT

5.1 To institutionalise the gains made towards a cleaner environment and to allow for comprehensive environmental management, the Ministry of the Environment was formed in September 1972. The new Ministry took over from the Ministry of Health and the Ministry of National Development those portfolios which dealt with environmental health and pollution control in the Republic.

5.2 Since its formation, the Ministry has adopted the philosophy that pollution must be controlled at source. It adopted a two-pronged strategy which aimed to provide an efficient environmental public health infrastructure and services, and to educate the public on the importance of maintaining a clean environment.

6 SOLID WASTE MANAGEMENT AND PUBLIC CLEANSING

6.1 Since its formation, the Ministry had to cope with increasing workload. Refuse output has been increasing because of population growth, rising affluence and industrial development. Appendix 1 shows the volume of refuse generated in the past 17 years. With urbanisation and development, the length of roads and kerbs that has to be swept has also increased.

6.2 To cope with the increased load, the Ministry has mechanised street cleansing. Mechanical suction sweepers were first introduced in 1972. Today, there are *50 suction sweepers and they sweep *4,900 kilometres of kerb-side. With the use of these vehicles, the Ministry is able to deploy one man to sweep the same distance which would otherwise require 16 men. Mechanisation was also introduced into its public cleansing programmes. Today, mechanised sweepers for cleansing of walkways and beach cleansing machines are deployed daily to reduce labour costs and increase productivity.

6.3 Mechanisation has also been extended to refuse collection. The Ministry has introduced rear loading refuse collection vehicles with compaction capabilities. Large capacity vehicles of up to 7 tonnes payload were introduced. Today, the Ministry has a fleet of *235 refuse collection vehicles.

* as at Dec 1993

6.4 Men and vehicles are deployed from 7 Environmental Health Offices daily to collect refuse from domestic and trade premises. About ***1.19 million tonnes** or **53%** of the refuse generated in Singapore is collected by the Ministry annually. Refuse from institutions and industrial premises collected by private waste collectors amounts to about ***1.04 million tonnes (47%)**, annually.

6.5 There are 4 main types of collection and these are as follows :-

a) Direct collection where refuse is manually removed from house-to-house and discharged into refuse collection vehicles. Occupiers are encouraged to put their refuse in plastic bags and to place the bags outside their premises daily for collection.

b) Indirect collection which is carried out in public and private high-rise housing estates. Refuse from high-rise apartment blocks is transferred to bulk-bins which are stored in bin centres. The contents of these bulk-bins are emptied daily into refuse collection vehicles.

c) Mixed collection where refuse is collected from a mixture of high-rise apartments and low-rise residential premises.

d) Bulky domestic refuse removal service which is provided on request for residents of low-rise residential premises.

6.6 At present about ***22%** of the refuse collected is disposed of by sanitary landfill at the dumping ground. The remaining ***78%** of the refuse is disposed of by incineration.

6.7 Incineration has been adopted because of the scarcity of land in Singapore. The method also achieves over 90% volume reduction in transforming refuse into ash. Three refuse incineration plants with a total capacity to handle 6,000 tonnes of refuse per day incinerates all "incinerable" waste.

6.8 With more development in Singapore, refuse disposal sites have to be located further away from industrial, trade and residential areas where refuse haulage costs become unavoidable. Singapore's first transfer station capable of handling 1,500 tonnes of refuse daily was commissioned in September 1986. With the completion of this transfer station, refuse collected from the eastern part of the island is transferred into large 20-tonne containers, and sent to the incineration plants on the western part of the island for disposal.

* as at Dec 1993

6.9 In 1983, the Ministry computerised its solid waste monitoring system. The computer keeps track of refuse vehicle deployment, manpower deployment and the volume of refuse disposed of. Computerisation enables the Ministry to plan its refuse collection and cleansing operations more speedily and efficiently.

7 PUBLIC EDUCATIONAL PROGRAMME

7.1 Besides providing an efficient system of public cleansing and waste disposal, the Ministry believes that it is equally important to have the public co-operation in keeping Singapore clean. Environmental public health education in this area aims to educate the public against littering as well as to dispose of their refuse properly. In addition, we also encourage the public to practice waste minimisation and resource conservation. Singaporeans are encouraged to recycle their wastes like paper and cans, and adopt a less wasteful lifestyle. This would enable the general public to be responsible for the cleanliness of their own environment. Towards this end, the Ministry supports as well as holds educational programmes jointly with "facilitator groups" such as the youth and grassroots organisations. The activities of these educational programmes include :-

- a) exhibitions at void decks of public high-rise apartment blocks, libraries and community centres,
- b) talks, educational film and video shows at void decks, community centres and schools,
- c) distribution of educational posters, stickers and coasters,
- d) physical clean-up activities in public housing estates, and
- e) competitions to pick the cleanest block of flats and neighbourhood in housing estates.

7.2 In 1987, the nation commemorated the 10-year clean up of the once polluted Singapore River and Kallang Basin. Following the one month commemoration, a long term education programme was launched for school children on keeping the rivers clean. In this programme, littering is highlighted as a major contributor to pollution of the cleaned-up rivers. Participants are brought to tall buildings to view the rivers and their surroundings so that they can appreciate, first-hand, the benefits of clean rivers. Their role in keeping these water courses clean is emphasized in an accompanying workbook and follow-up activities.

7.3 In March 1988, a national Anti-Littering campaign was conducted on the theme, "Singapore Is Our Home - Let's Keep It Clean and Beautiful". Preceding the campaign launch, there was an island-wide "No Sweeping" exercise where street cleansing was stopped for one day, to show the public that littering was still a problem. The campaign was given extensive mass media publicity. It was aimed at reminding the public not to litter and to emphasize the cost and effort expended on keeping the country clean. The focus was on public housing estates, where more than 85% of the population live, and public areas such as beaches, parks, roads and bus stops.

7.4 The Ministry organised the first "Clean & Green Week" (CGW) in November 1990. A series of activities targeted at schools, grassroots organisations and the business community, were organised on a daily basis throughout the CGW. Major programmes organised for the Week include tree-planting in housing estates, a "Care for the Environment" exhibition, "Ride and Walk" programme for the business community and an "Adopt A Beach and Park" programme for the school children. The objective of this public education programme is to promote and enhance the sense of care for the nature and the environment among Singaporeans. The second CGW was held in November 1991 with the theme "Resource Conservation and Nature Conservation". The third CGW in November 1992 had the theme Commitment and Energy Conservation. "Awareness and Action" was the theme for the Fourth CGW held in November 1993. Activities during the week, apart from tree planting, included the Singapore Green Plan Exhibition, the vision of Singapore as a model Green City by the year 2000.

7.5 Besides these campaigns, the Ministry also works very closely with the Ministry of Education to ensure that children are educated from young not to litter and to dispose of refuse properly using plastics bags. Assistance is provided to education officers in the production of teaching materials on this topic and talks are given to school children by officers from the Ministry.

7.6 On-going educational activities include the organising of visits for community and student groups to the Ministry's permanent exhibition "Towards A Clean Environment", and to installations such as the refuse incineration plants and sewage treatment works. These visits give the participants a better understanding of the efforts and resources that have been devoted to environmental improvement.

APPENDIX 1

TONNES OF REFUSE GENERATED

<u>YEAR</u>	<u>PER YEAR</u>	<u>PER DAY</u>
1977	742,572	2,034
1978	794,335	2,176
1979	875,722	2,399
1980	992,063	2,718
1981	1,082,455	2,966
1982	1,183,695	3,243
1983	1,374,800	3,767
1984	1,509,200	4,123
1985	1,498,500	4,105
1986	1,595,700	4,372
1987	1,872,900	5,131
1988	1,834,800	5,096
1989	1,979,075	5,422
1990	2,079,040	5,696
1991	2,151,675	5,895
1992	2,258,118	6,170
1993	2,232,000	6,115

SELETAR

SEWAGE TREATMENT WORKS



SEWERAGE DEPARTMENT
MINISTRY OF THE ENVIRONMENT
SINGAPORE

SELETAR SEWAGE TREATMENT WORKS

Brief History

Arising from the proposed housing and industrial development of the Ang Mo Kio, Yishun, Sembawang and Seletar areas, a plan was drawn in early 1975 for the construction of sewers, pumping stations and pumping mains to bring the wastewater from these areas to a new treatment works, now known as the Seletar Sewage Treatment Works.

The wastewater from houses and factories are collected in an underground system of sewer pipes and pumping stations which convey the wastewater to the Seletar Sewage Treatment Works where it is treated and disposed of at sea. This is to ensure that the wastewater does not pollute the rain water in drains or cause a public health hazard.

The design of the Works is based on the conventional activated sludge process using mechanical surface aerators. The effluent produced meets the Royal Commission Standards of 20 milligrams per litre for Biochemical Oxygen Demand and 30 milligrams per litre for Suspended Solids. The final effluent is discharged through a 2100mm diameter concrete pipeline into the sea.

Construction of the Works in two phases commenced in 1976 with Phase I completed in 1981 and Phase II in 1991 at a total cost of \$116 million. The Works has a total treatment capacity of 114,000m³ per day serving a population equivalent of 480,000 persons.

Treatment Process

Wastewater arriving at the Works is first passed through screens where rags and other fibrous materials are removed and then through detritors where grit and heavy solids are settled out for disposal. The wastewater next flows to the primary settlement tanks where suspended solids are allowed to settle. The settled solids called primary sludge is thickened at the consolidation tanks before being pumped to the digesters. The liquid from primary settlement tanks termed settled sewage flows into the aeration tanks.

At the aeration tanks, a biomass of microorganisms called activated sludge is mixed with the settled sewage. The aerobic bacteria consume the waste matter present in the settled sewage in the presence of oxygen which is provided by mechanical surface aerators. The final product from the aeration tanks called mixed liquor then flows into final settlement tanks where solid-liquid separation takes place. The activated sludge mass settles while the treated water known as final effluent flows to the sea.

The settled activated sludge is pumped back to the aeration tanks. This mass is referred to as the return activated sludge. However, to maintain a healthy balance of activated sludge and waste matter in the aeration basins, part of the activated sludge has to be removed from the system. This sludge is thickened in the Dissolved Air Flotation thickeners before being pumped to the digesters.

In the digesters, another culture of bacteria thriving in an oxygen deficient environment breaks down the organic substances in the sludge, and makes it 'stable'. A by-product of the digestion process is sludge gas or biogas which contains 60-70% methane. The gas is used as fuel for the dual-fuel engine generators which generate electrical power for the Works. The gas supplies about 30 to 40% of the Works' power requirement. The digested or 'stable' sludge is dewatered by plate and belt presses and the final product used as a soil conditioner.

The final effluent flows into the sea through a 2100mm diameter pipeline. Part of the final effluent is used in the Works for cooling of equipment, washing, preparation of chemical solutions and watering of plants and trees.

SELETAR SEWAGE TREATMENT WORKS

Basic Design Parameters

Present Treatment Capacity	:	114,000 m ³ /day
Catchment Area Served	:	7,400 hectares
Equivalent Population Served	:	480,000 persons
Influent BOD/SS Concentration	:	295 mg/litre
Daily BOD/SS Load	:	33,600 kg/day
Total Sludge Yield	:	39,800 kg/day
Effluent Standard	:	30 : 20 mg/litre (SS : BOD)
Overall Removal Efficiencies	:	93% for BOD, 90% for SS
Ultimate Treatment Capacity	:	306,000 m ³ /day
Total Land Area	:	54 hectares
Area Occupied By Existing Units	:	24 hectares

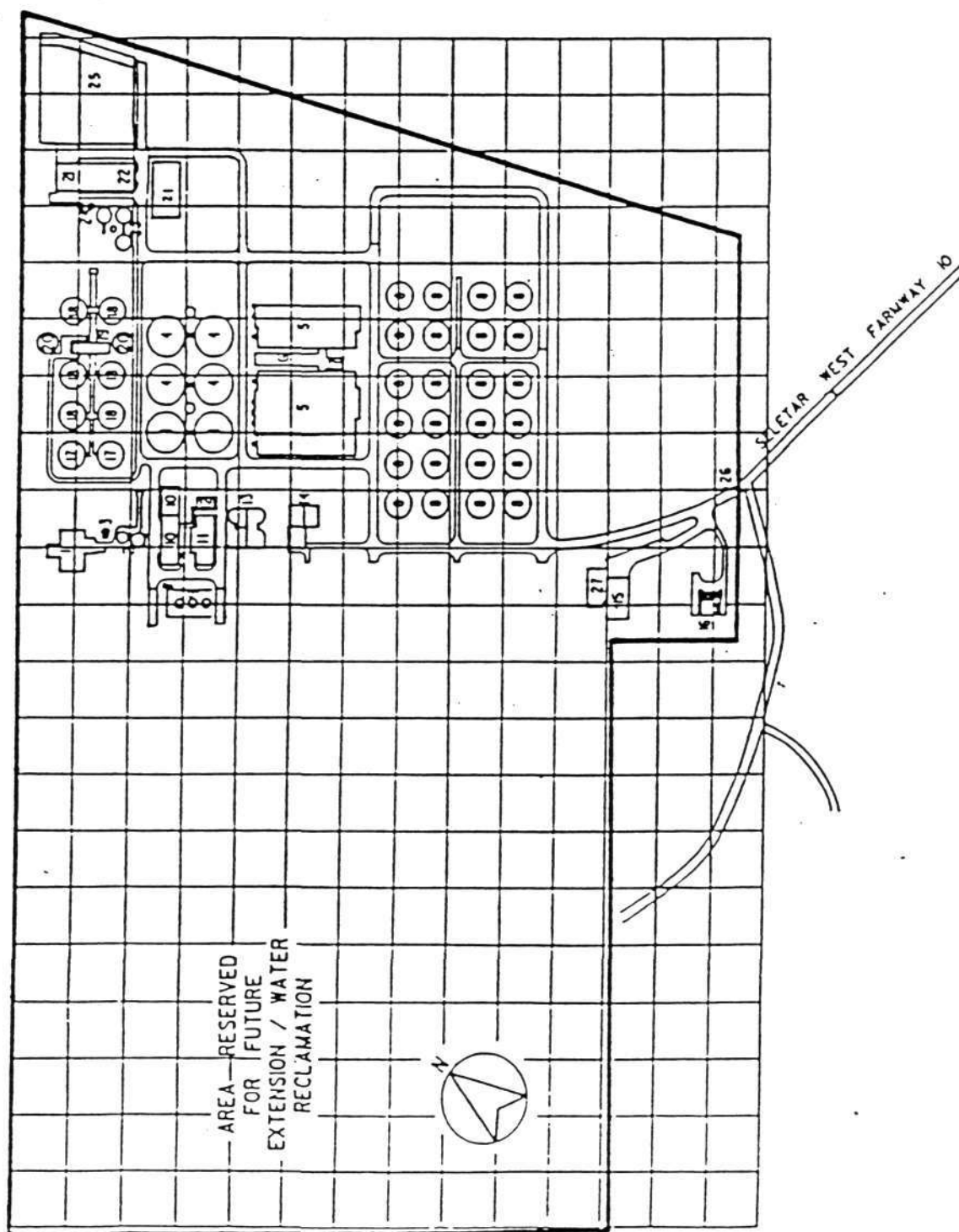
Main Treatment Units and Equipment

	<u>No</u>	<u>Capacity/Size (Per Unit)</u>
Main Sewage Pumps	5	625 l/s
	2	270 l/s
Fine Screens	4	1.5 m wide; 12 mm opening
Grit Detritors	1	12 m diameter
	1	10 m diameter
Primary Settlement Tanks	6	2,333 m ³
Aeration Tanks	6	7,290 m ³
Mechanical Surface Aerators	30	150 kg O ₂ /hr
Final Settlement Tanks	24	1,037 m ³
Return Activated Sludge Screw Pumps	4	1,100 l/s
Dissolved Air Flotation Thickeners	3	46 m ² (Surface Area) 10 Kg/m ² hr (Solids Loading)
Consolidation Tanks	3	369 m ³
Digesters	6	4,800 m ³
Sludge Storage Tanks	2	4,800 m ³
Gas Holders	2	1,742 m ³
Gas Recirculation Compressors	8	510 m ³ /hr
Filter Plate Presses	6	90 Plates of size 1200 x 1200 x 25 mm
Belt Presses	3	600 kg/hr
Dual Fuel Engine	3	930 kVA; 790 kW
	2	2,100 kVA; 1,755 kW
Oil Storage Tanks	1	500,000 litres
	2	750,000 litres

Operating Cost Per Year

Manpower	:	\$1,800,000
Energy	:	\$1,300,000
Repairs & Maintenance	:	\$1,100,000
TOTAL	:	<u>\$4,200,000</u>
Approximate Cost of Sewage Treatment	:	\$0.10 per m ³

SELETAR SEWAGE TREATMENT WORKS GENERAL LAYOUT PLAN



LEGEND

- | | |
|----|--|
| 1 | INLET WORKS |
| 2 | DETURITORS |
| 3 | GRIT ELEVATORS |
| 4 | PRIMARY SETTLEMENT TANKS |
| 5 | AERATION TANKS |
| 6 | CONTROL ROOM |
| 7 | R.A.S. PUMPING STATION |
| 8 | FINAL SETTLEMENT TANKS |
| 9 | OIL STORAGE TANKS |
| 10 | POWER STATION |
| 11 | MAINTENANCE COMPLEX |
| 12 | ATTENDANTS FACILITIES |
| 13 | CONSOLIDATION TANKS |
| 14 | CENTRAL BUILDING COMPLEX |
| 15 | ADMINISTRATION BLOCK |
| 16 | ELECTRICAL SUB-STATION |
| 17 | SLUDGE STORAGE TANKS |
| 18 | SLUDGE DIGESTION TANKS |
| 19 | GAS COMPRESSOR HOUSE |
| 20 | GAS HOLDERS |
| 21 | PRESS HOUSE |
| 22 | CHEMICAL STORAGE |
| 23 | ELUTRIATION TANKS |
| 24 | CONDITIONING TANKS |
| 25 | SLUDGE STORAGE AREA |
| 26 | GUARD HOUSE |
| 27 | CAR PARK |
| | PHASE I UNITS |
| | PHASE II UNITS |
| | BOUNDARY OF SELETAR SEWAGE TREATMENT WORKS |

SELETAR SEWAGE TREATMENT WORKS - FLOW DIAGRAM

