Ⅷ. 添付資料

1. 帰国研修員名簿

都市排水コース　研修員名簿

マレイシア

	名前・所属先	所属先住所
平成3年（1991年） 	Mr. Ab. Razak Bin Ismail Civil Engineer Kota Bharu Municipal Council	Majlis Perbandaran'Kota Bharu, Jalan Hospital, 15990 Kota Bharu, Kelantan, West Malaysia
平成6年（1994年） 	Mr. Ong Soon Haw Assistant Director, Sewerage Services Department, Ministry of Housing and Local Government	Level 1, Block G South Damansara Town Centre, Kuala Lumpur

都市廃棄物対策コース　研修員名簿

マレイシア

	名前・所属先	所属先住所
平成5年（1993年） 	Mr. Kamarulzaman bin Yahya Senior Health Inspector, Majlis Bandaraya Ipoh	Majlis Bandaraya Ipoh Peti Surat 1009, 30820 Ipoh, Perak
平成6年（1994年） 	Mr. Sandianysamy Mariannan Health Inspector Health Department, Ipoh City Council	No.19, Hala Silibin Satu, Taman Grand Silibin, 30100 Ipoh, Perak, Malaysia

都市廃棄物対策コース　研修員名簿

中　国

	名前・所属先	所属先住所
平成4年（1992年） 	Mr. Chen Hua Shenyang Special Environmental Protection Engineering Complex, Chief of Environmental Protection Section, Waste Management and Waste Disposal Research	No.118 Renao Road Shenhe Dist. Shenyang (110011) P.R. China
平成6年（1994年） 	Mr. QI, Xiao-Li Vice Director of Development Dept. Xi'an Environmental Sanitation Science Institute	2 Sixth Xixie Road, Xi'an 710068, P.R. China
平成7年（1995年） 	Mr. Yang, Chang-Liang Environmental Engineer, Kunming Research Institute of Environmental Science	1 South Xingwen Road Kunming, Yunnan P.R. China
平成8年（1996年） 	Ms. Hu, Gui-Ping Sandy Engineer, Guangzhou Environment Monitoring Center Station	No.95 Jixiang Road, Guangzhou, China

2．主要面談者リスト（日程順、敬称略）

中華人民共和国

JICA中国事務所

熊岸　健治	所長
熊谷　晃子	副参事
Dr. Huang Xia	精華大学副教授（北京での通訳）

国家環境保護局（NEPA）

Mr. Xie Yongming	Deputy Director, Division of Bilateral Cooperation
Mr. Zhong Xiadong	Programme Officer
Mr. Zhou Beihai	Associate Professor, Wastes Importation Registration & Management Division, National Environmental Centre for Analysis & Measurement

水汚染・廃水資源化研究センター（JICAプロジェクト）

伊藤　一男	チーフアドバイザー
宮田　義昭	長期専門家
舘　　和彦	〃
大澤　理恵	業務調整員

帰国研修員との面談

Mr. Qi, Xiao-Li	Vice Director of Development Dept., Xi'an Environmental Sanitation Science Institute
Mr. Yang, Cham-Liang	Environmental Engineer, Kunming Research Institute of Environmental Science
Ms. Hu, Gui-Ping Sandy	Engineer, Guanzhou Environment Monitoring Center Station

広州市李坑廃棄物処理場

Mr. Yan Runtian	Head, Likeng Refuse Sanitary Landfill Station of Guanzhou

広州市政府

Ms. Hu Shan Yu	Deputy Director, Guanzhou Municipal Environmental Protection Bureau
Mr. Yang Sheng Ye	Foreign Economic Dept. Construction Commision of Guanzhou Municipality

広州市科学技術委員会

Mr. Liu Zhen Yong	Director, International Science & Technology Cooperation Dept.
Mr. Zhang Nan Feng	Deputy Director, International Science & Technology Cooperation Dept.
Mr. Zhong Hui	Section Chief, International Science & Technology Cooperation Dept.
Mr. Liu Jian Wei	Section Chief Engineer, International Science & Technology Cooperation Dept.

マレイシア

JICAマレイシア事務所

西牧　隆壮	所長
山田　好一	次長
飛田　賢治	副参事
進藤　裕之	専門家（河川工学）

在マレイシア日本大使館

森　　勝彦	二等書記官

Min. of Housing and Local Govt.

Mr. Lum Weng Kee	Direcor General, Dept. of Sewerage Services

Min. of Health

Mr. Tan Hoo	Deputy Director Engineering (Environmental Health), Engineerting Division

Ipoh City Hall

Dr. Ngiam Swee Keat	City Health Officer
Mr. Sandianysamy Mariannan	Health Inspector

技術セミナー

Ms. Kamariah Bt. Mohd Noor	Senior Manager, Operations Planning（セミナー講師）

Indah Water Operations SDN. BHD.

Mr. Razali Mohd. Rais	Unit Manager
Mr. Wan Ahmad Sufian	Manager, Communications Division

Dept. of Irrigation and Drainage

Mr. Liew Chin Loong	Director

Public Service Dept.

Ms. Rojeah Hashim	Assistant Director, Look East Policy Section

Seminar on Environmental Management in Urban Area

Outline of Urban Water Drainage and Japanese Experience in Osaka City	Satoshi YAMAMOTO Staff Officer, Planning Department, Construction Division, Sewage Works Bureau, Osaka Municipal Government
Solid Waste Management Administration in Osaka City	Toru TAKAGI Chief, Public Relation Section, General Affairs Department, Environmental Bureau, Osaka Municipal Government
The Strategies and Measures for Promoting Pollution Prevention and Cleaner Production by the Government and Industries, Japanese Experience	Kunitoshi SAKURAI President, Tokyo International Environmental Planning Institute

Japan International Cooperation Agency

Osaka International Centre / Malaysia Office

Public Seminar Text (Urban Stormwater Drainage Course)

Outline of Urban Drainage in Japan and its Practical Operation in Osaka City

1. Characteristics of Urban Drainage

Japan is an island country with an interior consisting seven-tenths of mountainous terrain and a series of alluvial plains formed over many years by the accumulation of river-borne silt and sand. The country's average annual precipitation of 1800 mm is twice the world average and is distributed in a pattern marked by heavy falls in the rainy season of June and July and the typhoon season of September. Major cities such as Tokyo, Yokohama, Osaka and Nagoya grew up around river estuaries offering convenient water transport; consequently, the majority of the population is concentrated in the coastal plain, which represents only one tenth of the country's land area. These cities thus occupy mostly low-lying flat land — unfavorable natural conditions for the drainage of stormwater.

In the post-war economic boom, Japan's major cities underwent rapid urbanization, leading to a sudden increase in the volume of stormwater runoff. In addition, newly established water-using industries began to pump up groundwater, which caused subsidence and depressed stormwater drainage capacity.

Today, subsidence has been halted by regulations imposed on extraction of groundwater and the introduction of an industrial water supply system, while construction of trunk sewers and pumping stations is now underway to cope with the increased stormwater runoff volume.

2. Role of Sewerage and its History in Japan

Sewerage serves the following three purposes:

1. To prevent flooding through drainage of stormwater

2. To maintain a healthy environment by collecting and treating wastewater

3. To maintain and improve the water quality of public water bodies

The sewerage system is thus a basic infrastructural element in ensuring that urban life can be led in safety and comfort. Inadequate sewer drainage leads not only to flooding by stormwater but also to the outbreak of infectious diseases due to unhygienic environmental conditions resulting from accumulation of wastewater.

A modern sewerage system was introduced in Japan in 1884, and the Sewerage Law was enacted in 1900. At the time however, priority regarding the development of hygienic facilities was given to the water supply system; since a system of drainage ditches was already in operation, there was little demand in the country as a whole for a sewerage system, and the level of interest in such projects was low. As a result, little progress was made in the development of a sewerage system for wastewater drainage. In the period up to 1940, some 50 municipalities initiated sewerage projects, in many cases as a strategy against unemployment, and the number of citizens connected to the sewerage system rose to 5 million or 5% of the total population. For a time after the war, fiscal pressures prevented the expansion of the sewerage system. However, since the 1970's, when water pollution and other environmental problems attendant on the economic revival reached serious proportions and a series of anti-pollution laws was enacted in quick succession, the sewerage system has developed steadily, so that as of 1996, the sewerage population had reached 54% of the total.

3. The Sewerage System in Osaka

1) Natural conditions

Osaka is situated at the midpoint of the great north-south sweep of the Japanese archipelago (Fig. 1). Its climate is marked by variation between the summer average temperature of 30°C and the winter overage of less than 5°C. Yearly rainfall is 1400 mm with heavy falls in the rainy season of June and July and the typhoon season of September; four tenths of the yearly total is concentrated in these three months (Fig. 2).

Regarding the city's topography, while the area known as the Uemachi Plateau has been dry land since prehistoric times, 90% of the rest is delta land formed on what was once the seabed by the accumulation of river-borne silt and sand, and is flat and low-lying (Figs. 3-4).

2) Development of Sewerage Facilities up to the mid-20th Century

Osaka is an ancient city which flourished as Japan's capital in the 5th-6th centuries. In the 16th century, Osaka was developed as a commercial center, and the blueprint of the modern city were laid; the city's streets were laid out in a grid pattern and a large number of canals was built to facilitate water transport (Fig. 5). At the same time, drainage ditches were installed to the rear of houses to drain stormwater and wastewater into the canals. Some drainage ditches of this period are still in use as sewers today (Photo 1).

Around the end of the 19th century, Osaka saw the development of industrial as well as the existing commercial activity; population density increased and the built-up area expanded. It was against this background that Osaka's municipal government was set up in 1889. At the time the city had about 350 km of drainage ditches, but as drainage was insufficient, outbreaks of cholera and other infectious diseases began to occur. To counteract this, the municipal government began a sewerage project in the city center from 1894, whereby existing drainage ditches were covered over and brick sewers were built. This was the beginning of Osaka's modern sewage works.

After the turn of the century, the municipality became preoccupied with railway and port construction projects and the sewerage system fell out of fiscal favor. Then, in 1919, with the enactment of the City Planning Law, it was established that beneficiaries could be charged for services, and this principle was applied to the sewerage system. Since 1940, when the municipality introduced wastewater treatment, the maintenance of sewerage facilities has been financed by the levy of a so-called sewerage users' charge, which has remained the basis of the system's operation.

3) Flood Prevention Measures from the mid-20th Century

The economic revival of the 1950's brought severe land subsidence so that protection against high tides became the focus of flood prevention. In reaction to frequent episodes of high-tide flooding, dyke heights were raised repeatedly, pumping stations were installed at the entrance to waterways, and floodgates were built (Fig. 6, Photo 2). These measures were somewhat *ad hoc* due to the fiscal conditions of the time, but produced rapid results. The 1962 revision of the Industrial Water Supply Law saw the construction of a water supply system for industry and regulated the pumping up of groundwater, so that land subsidence was quickly halted (Fig. 7). However, the effect of the subsidence already suffered — up to two meters in the worst places — particularly on land which had been low-lying to start with and thus for the most part not drainable naturally, meant that from then on, pumps were necessary in most parts of the city to expel wastewater into the rivers or the sea. (Figs. 8-9). Today, 57 pumping stations are operated in Osaka to drain stormwater.

Major aims of post-war sewerage development programs were to put an end to flooding and to inappropriate disposal of human waste, and to do so while extracting the maximum benefit from strictly limited budgets. Construction of pumping stations and sewers was therefore the main focus of investment. From the 1960's, the wastewater system became the priority. As a result, the total length of sewers increased substantially, expanding from 2200 km to 3700 km between 1965 and 1975 alone, and the area served by the drainage system grew to cover 90% of the city area (Fig. 10). In the course of this process, waterways which had become no more than open drains were channelled into underground culverts or covered over and turned into roadways. There were thus great improvements in the city's environment. Meanwhile, the 1963 amendment of the Regional Public Utility Law established the principle that sewerage construction, maintenance, and operation should be paid for by levy of a users' fee in the case of costs relating to wastewater treatment and by the municipality in the case of costs relating to stormwater drainage. As for wastewater treatment plants, pumping stations, trunk sewers and other basic infrastructural items, half of the cost of these is borne by central government.

4) Prevention of Urban-Type Flooding

While large-scale flooding has become less frequent as a result of the extension of the sewerage system, areas of the city previously unaffected by flooding and where a full sewerage system is already in place have recently become prone to inundation (Fig. 11). In particular, large-scale flooding occurred in the southeast of the city in 1979 and 1982. This so-called urban-type flooding occurs in built-up areas with an operational sewerage system even at rainfall levels within the limits planned for. The cause of this phenomenon is rapid increase in stormwater runoff volume resulting from the two urbanization-related factors cited below (Fig. 12).

1. Infilling of the canals and ponds which had traditionally fulfilled the function of holding water
2. Reduced ability of the ground to absorb water due to expansion of paved and built-over area and converse shrinkage of field and open land area.

In a city such as Osaka where natural drainage of stormwater is not possible, this has to be done artificially, which requires an organic link between sewers and rivers. The basis of this is a division of tasks whereby the sewers perform the job of draining stormwater from the city precincts into the rivers, and the rivers that of transporting this stormwater downstream.

Following consideration of the appropriate scale of investment, Osaka's sewerage facilities have been designed to cope with a rainstorm of the kind which might occur once in ten years (60 mm of rain in one hour). The formula for calculating stormwater runoff volume in such an event (experimental formula, Formula 1) was originally established assuming the presence of field and open land area, and used a runoff coefficient of 0.5; in 1979 this was revised to 0.8 to match actual conditions. The revised calculation gave a greatly increased runoff volume. A plan was formulated to cope with the increased volume of stormwater runoff with new trunk sewers and pumping stations. This building of major trunk sewers for stormwater and large pumping stations began in earnest in the 1980's and continues today (Fig. 13).

Rivers also need to be prepared to take up the increased volume of stormwater runoff. Where rivers can no longer widen due to building over of the riverside area, plans have been made to construct underground rivers to expand conducting capacity, and some of these are now under construction.

From now into the early 21st century, flood prevention will continue to be the greatest priority in the work of Osaka's sewage works; in the eighth five-year plan, to be implemented from fiscal year 1997, of the total expenditure of 3.4 billion yen, 1.56 billion is earmarked for investment in flood prevention. The expenditure will cover the building of large-scale trunk sewers reserved for use during rainy weather, construction of pumping stations, installation of small-scale drainage pumps to serve local areas of low-lying land, and other finely tuned flood prevention measures (Figs. 14-15).

In a city such as Osaka which forms the hub of commercial activities, information networks, transport networks and other highly developed urban functions, a flood can have incalculable effects. The following projects to improve flood safety are therefore under consideration or in planning .

1. Underground stormwater absorbing facilities, underground holding facilities

These are intended to to reduce runoff volume by allowing rainwater to be absorbed into the ground surface and stored underground (Fig. 16).

2. Development of a real-time control system for stormwater drainage using independent radar data on rainfall

This system would use detailed radar data on rainfall to forecast local stormwater runoff volume even in the case of a highly localized downpour and allow appropriate deployment of pumps (Photo 3).

3. Networking of trunk sewers

This would improve flood safety by establishing interconnections between trunk sewers so that, in the case of a localized downpour, stormwater from the affected area can be drained if needed with the help of pumps in neighboring areas (Fig. 17).

4. Conclusion

Because of its low-lying position, Osaka has always been threatened by flooding at times of heavy rainfall. Each incident of flooding has taken a heavy toll on the functions of the city and the life of its inhabitants. Flood prevention is therefore one of the most important elements in safeguarding the city's livelihood, and a range of flood prevention measures relating to both rivers and sewerage has been implemented. However, since flood prevention installations within the sewerage system require large amounts of money and time to build and heavy investment of labor to maintain and operate, securing of funds is a crucial issue. The sewage works therefore need to take a long-term planning view and to create an understanding of their work through publicity activities aimed at the city council and city residents.

Experimental Formula

$$Q=\frac{1}{360}\ C\cdot R\cdot A\sqrt[6]{\frac{S}{A}} \quad \cdots\cdots \quad \text{Formula 1}$$

Q: design stormwater flow (m^3/s)

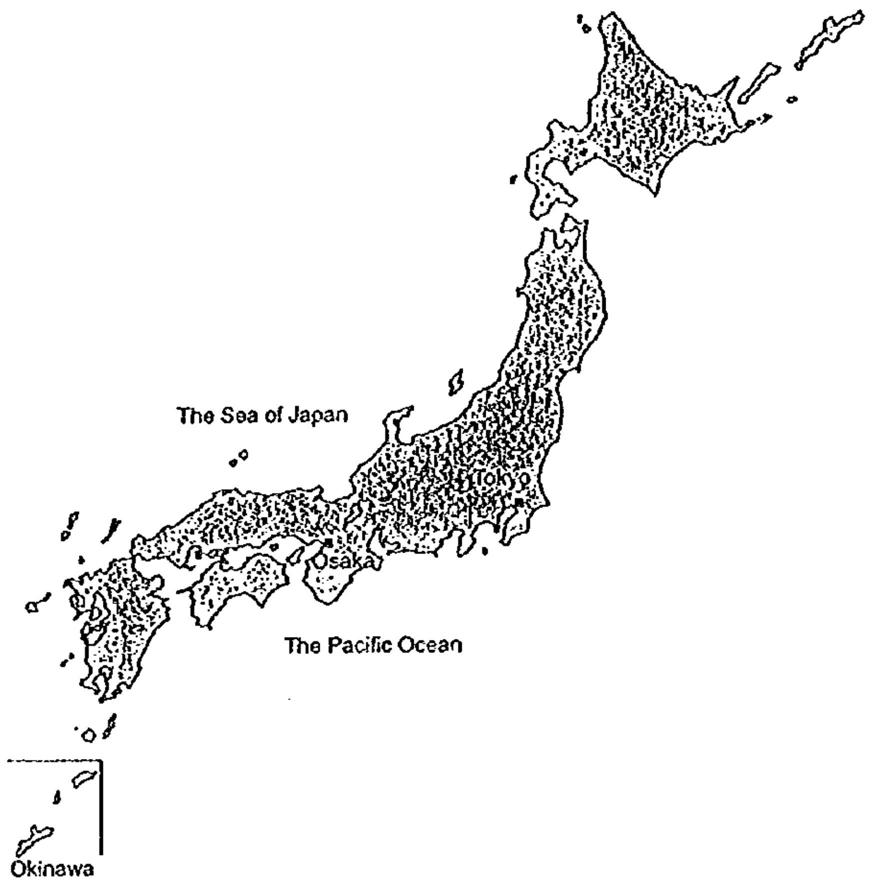
C: coefficient of stormwater runoff

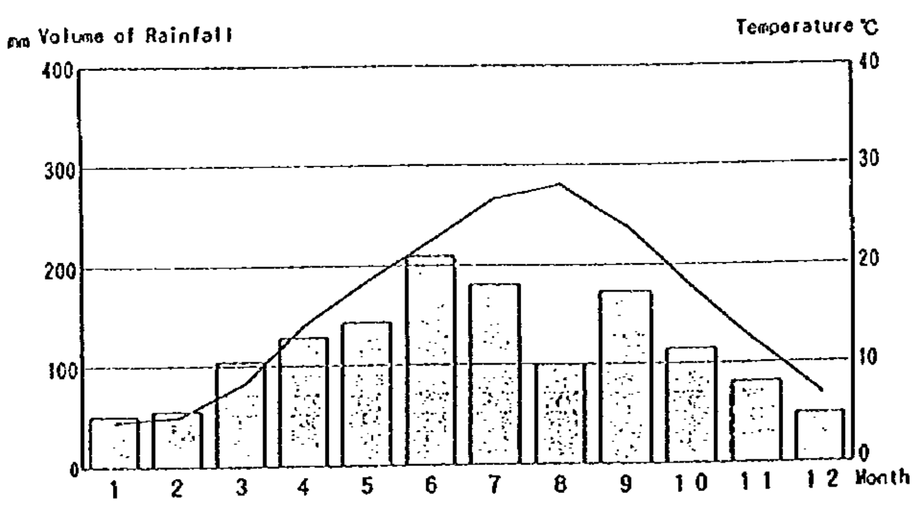
R: design hourly rainfall intensity (60 mm/hr)

A: drainage area (hectares)

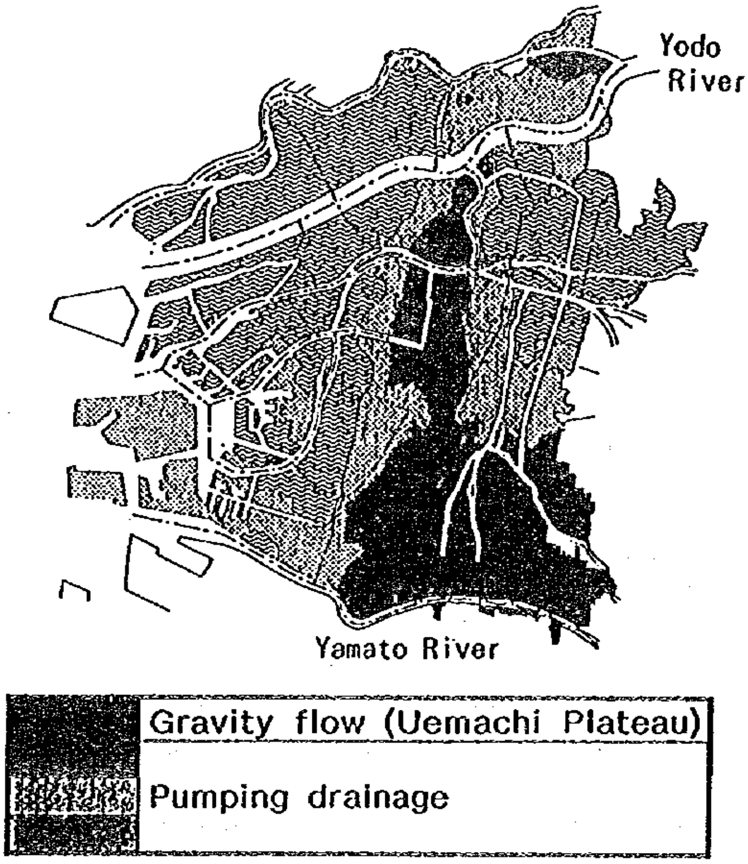
S: average gradient of land ($^0/_{00}$)

Japan

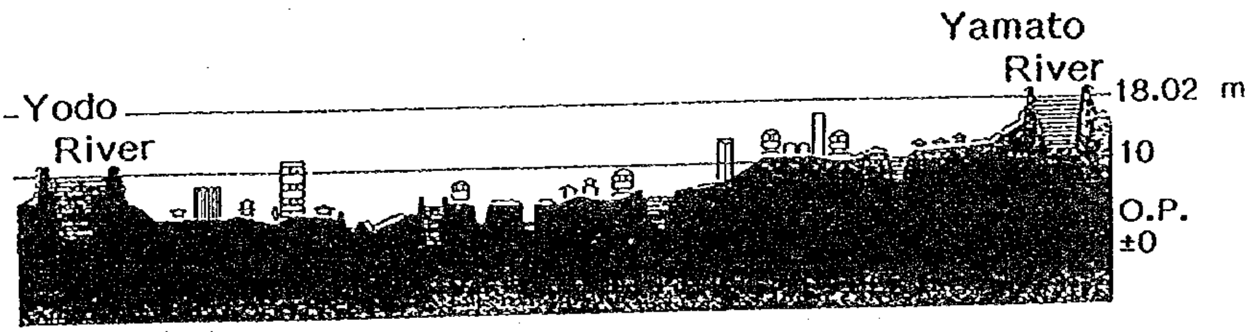

The Sea of Japan
Tokyo
Osaka
The Pacific Ocean
Okinawa


mm Volume of Rainfall
Temperature ℃
400
300
200
100
0
40
30
20
10
0
1
2
3
4
5
6
7
8
9
10
11
12
Month

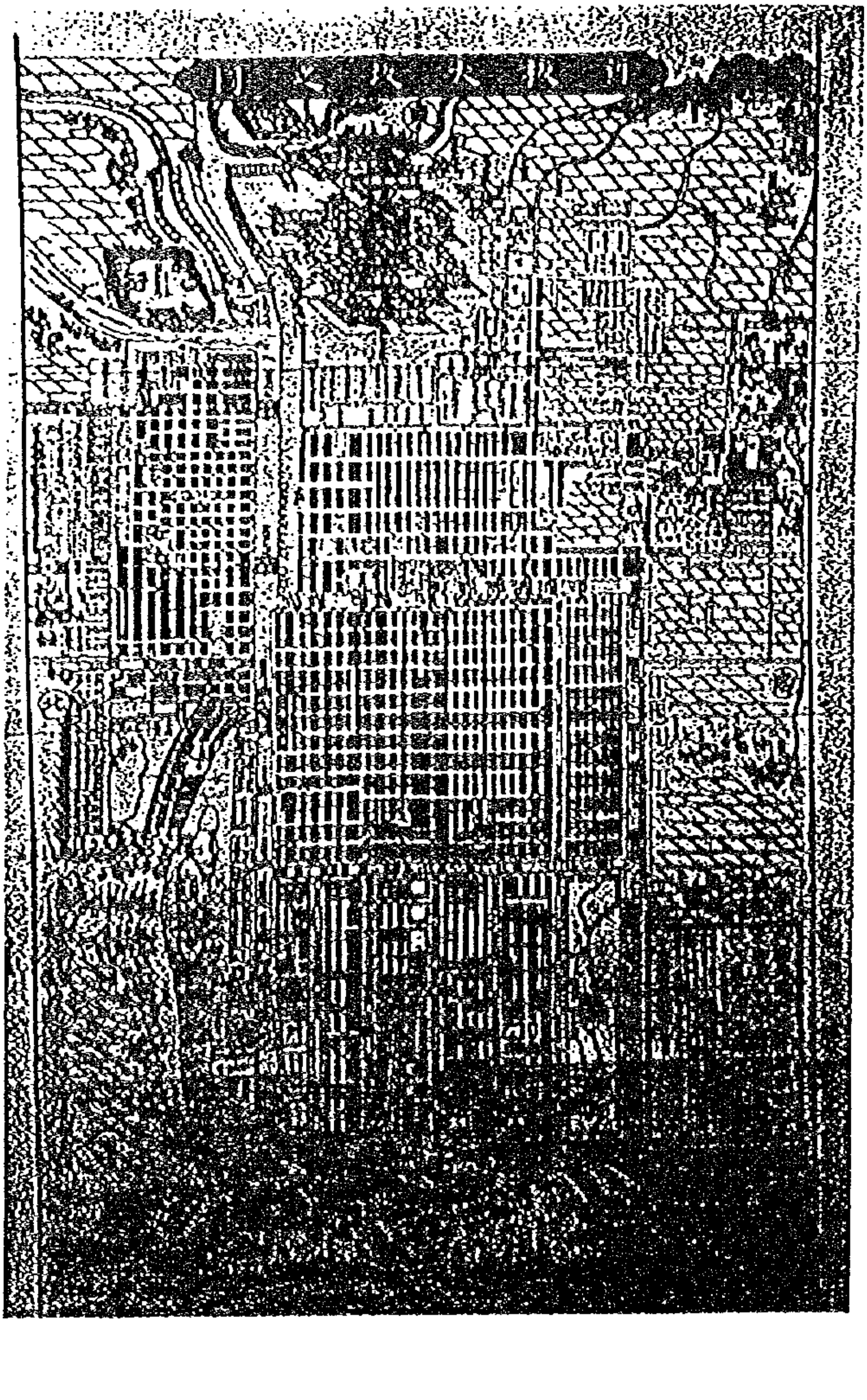
Topography of Osaka City



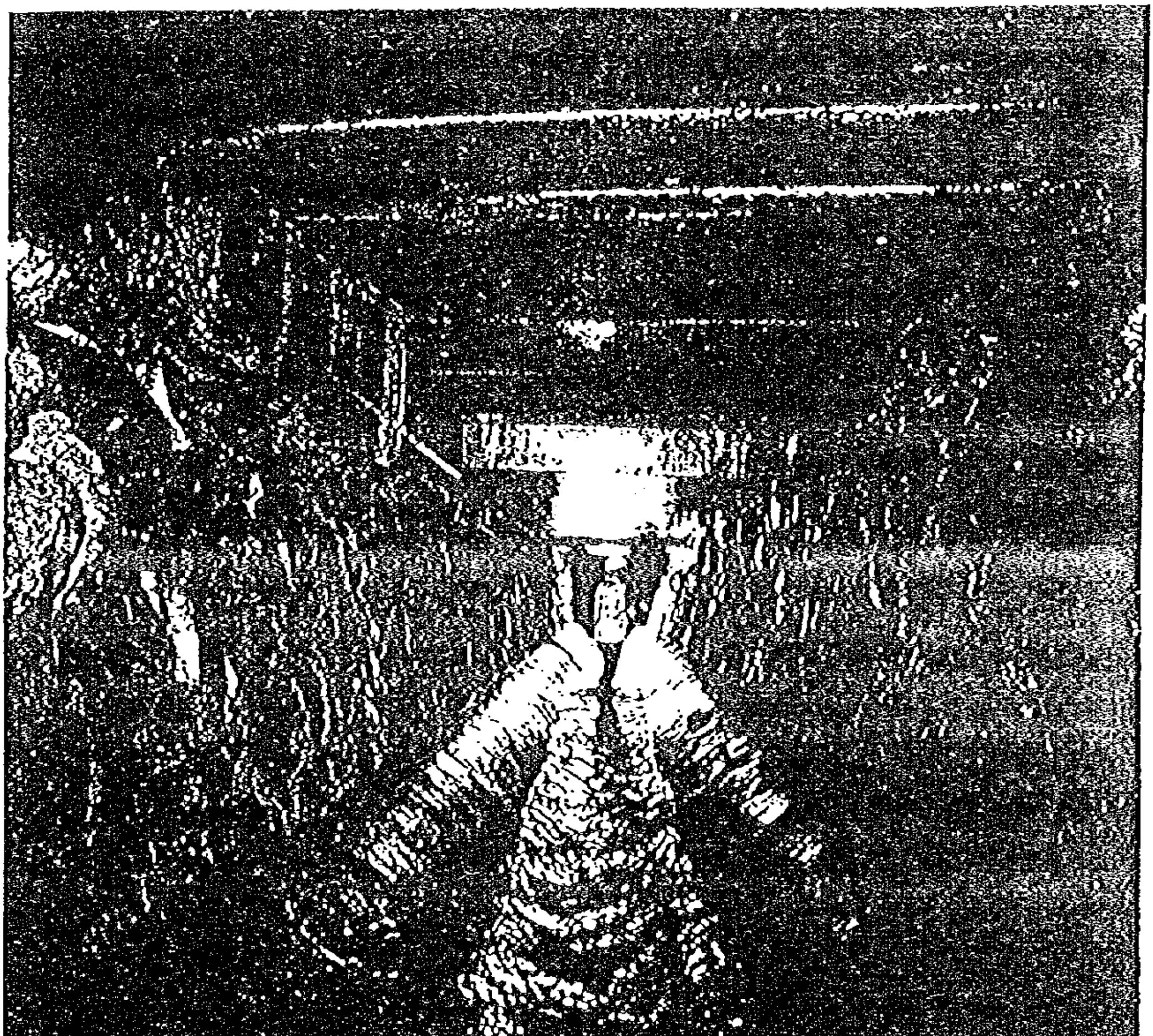
GROUND LEVEL DIAGRAM (NORTH TO SOUTH) SECTION



Osaka City in 1657
—Osaka City and the Grid-type Road Pattern



Ditches at Rear of Houses
—"Sewari-Gesui"—



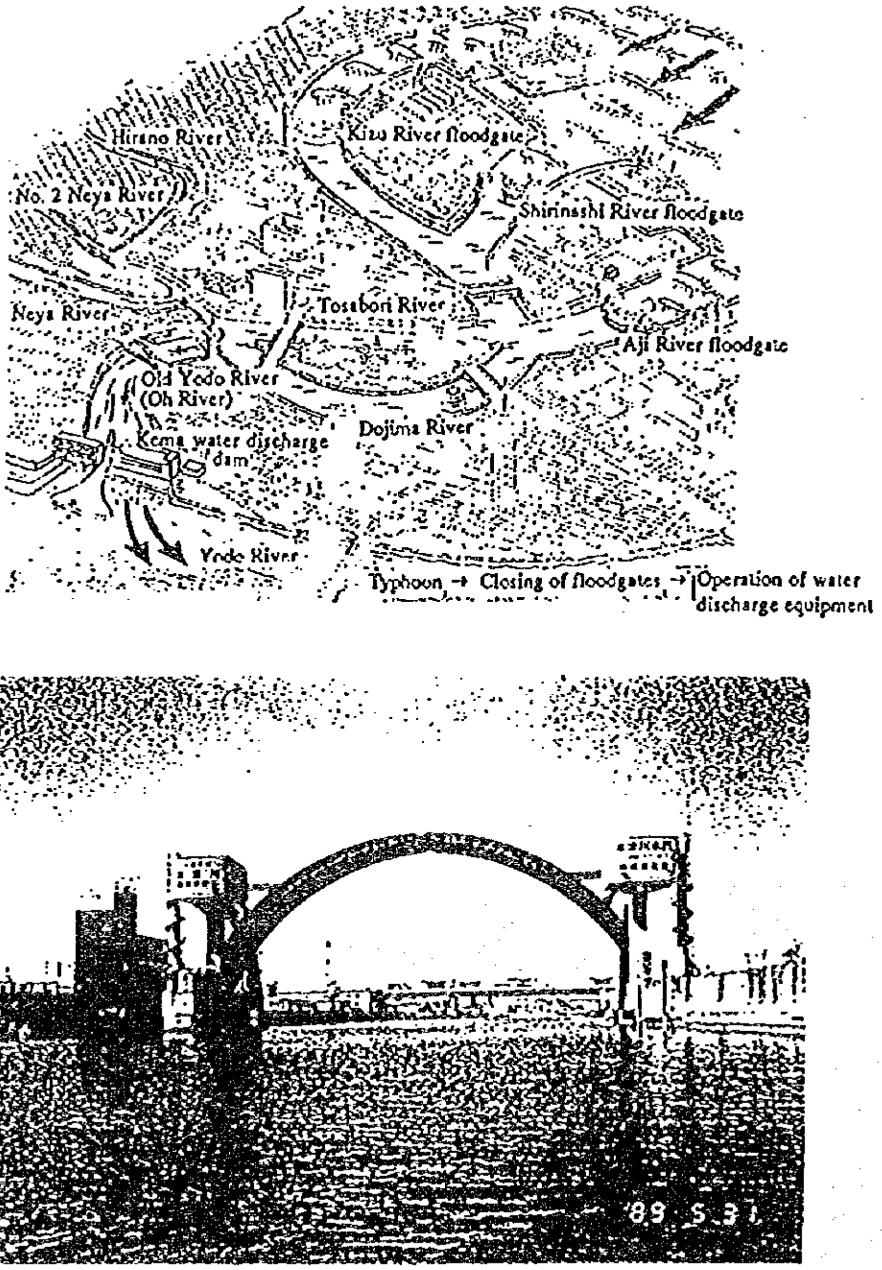
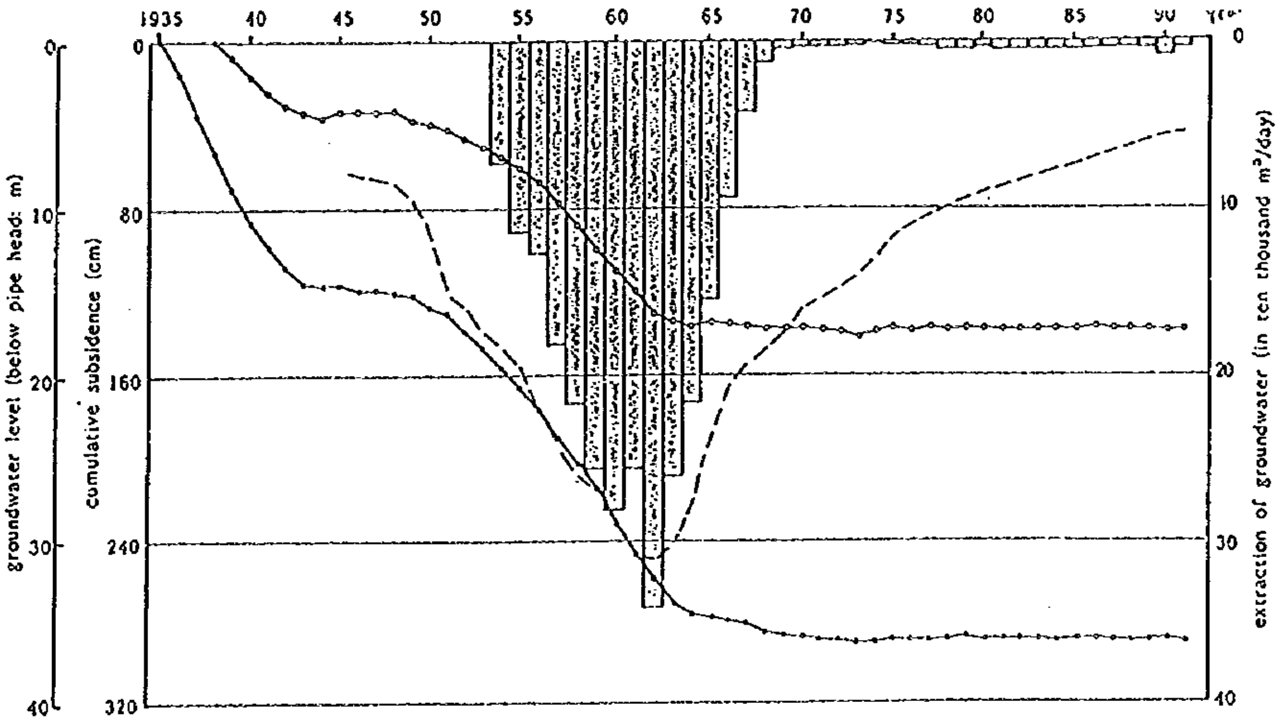


Photo 2 Measure against high tides in Osaka



--- Groundwater level
•—• Cumulative land subsidence (at Nishi-45 point)
•—• Cumulative land subsidence (at Nishi-4 point)
▭ Volume of groundwater extraction (Osaka City in total)

Remarks : Before 1961, the survey was conducted to the wells equipped with pumps more than 2 inches diameter. After 1962, with more than 1 inch diameter.

Fig. 8. Relationship between the amount of groundwater extraction, the groundwater level, and the cumulative amount of land subsidence in Osaka City.

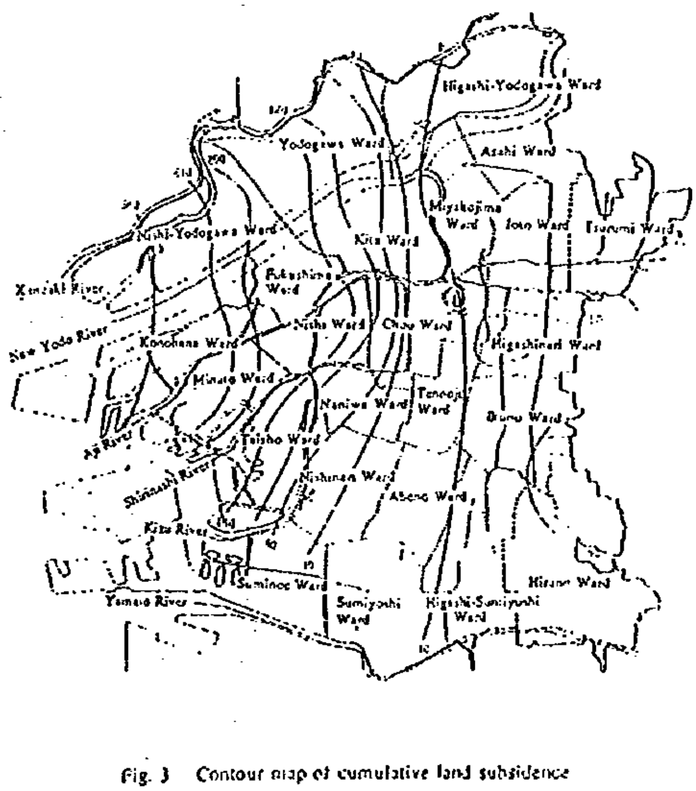
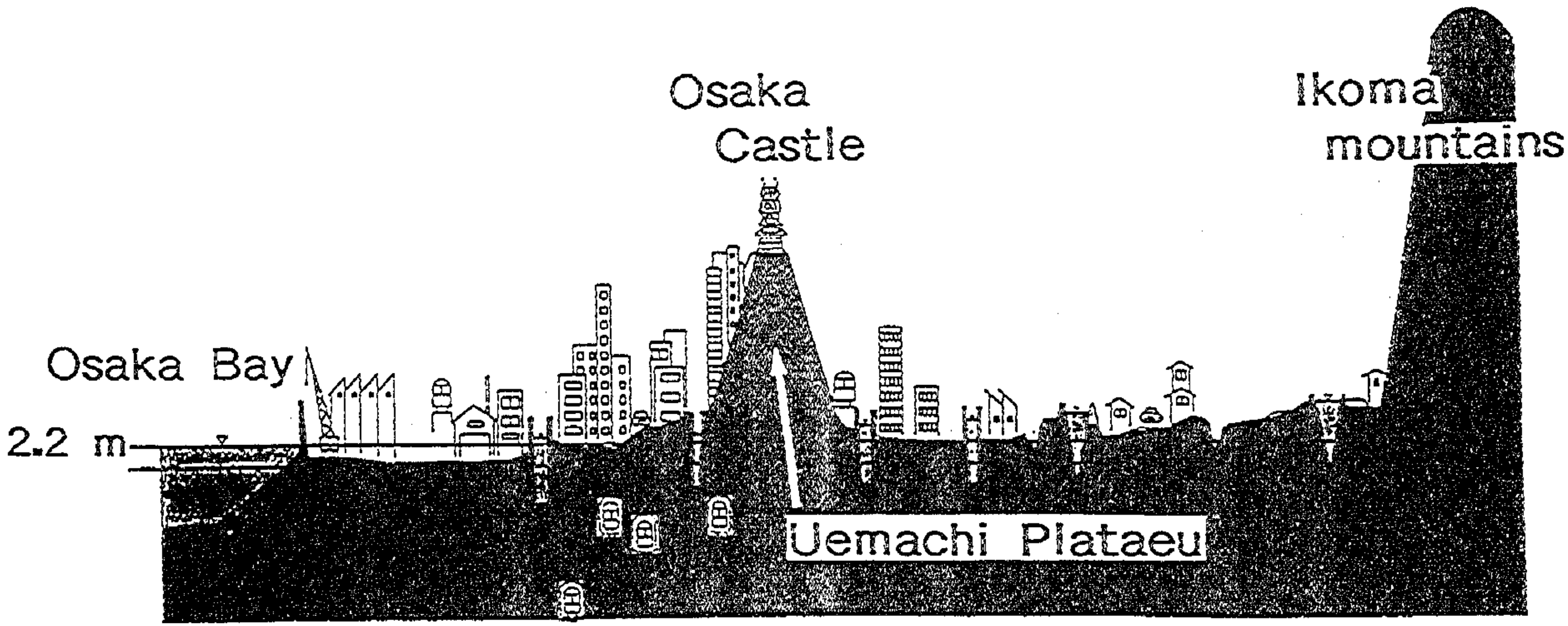
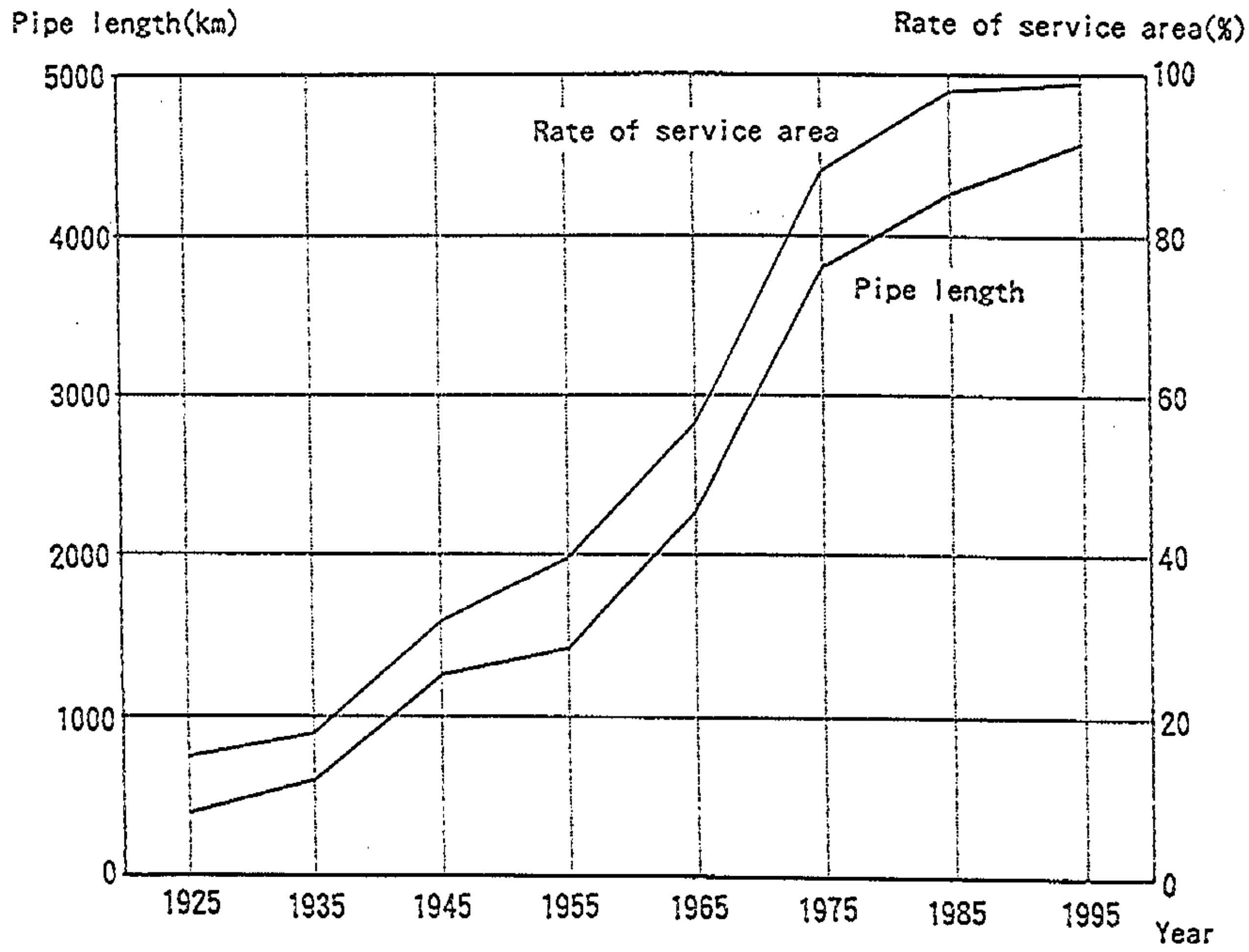


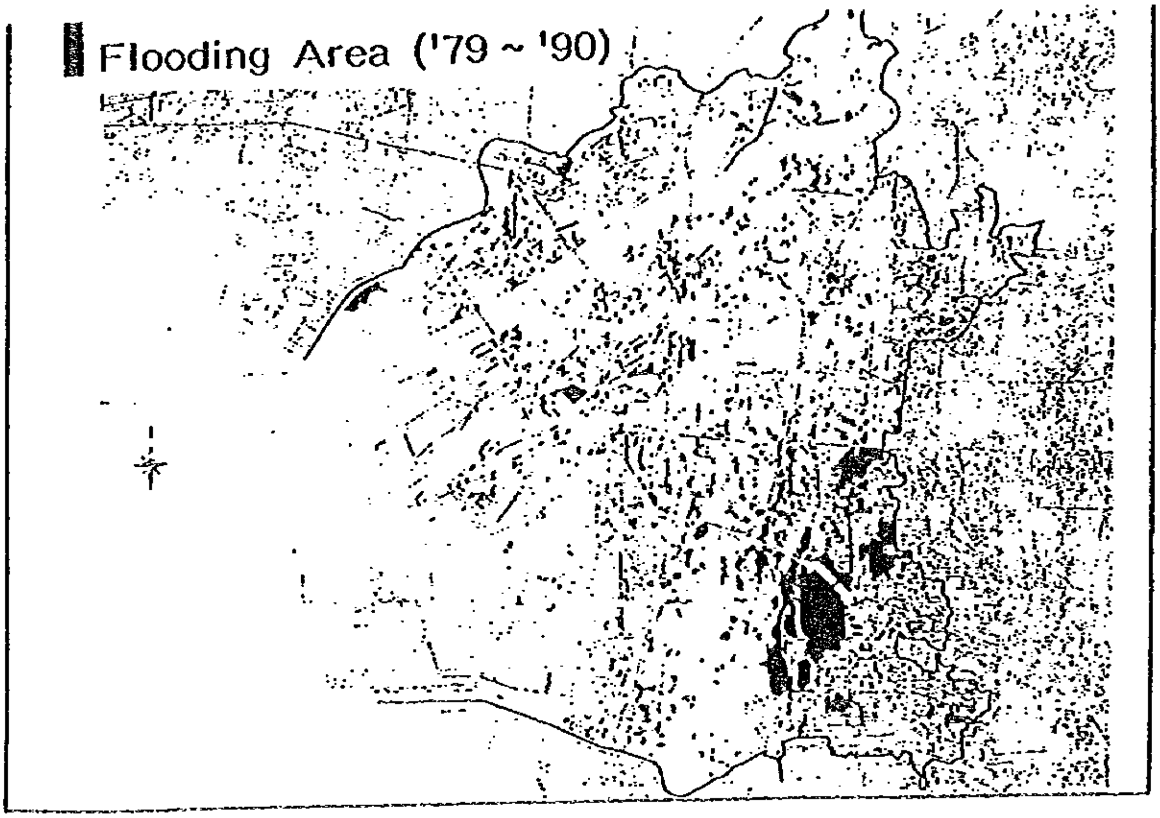
Fig. 3 Contour map of cumulative land subsidence

GROUND LEVEL DIAGRAM (EAST TO WEST) SECTION




Pipe length(km)
Rate of service area(%)
5000
4000
3000
2000
1000
0
100
80
60
40
20
0
Rate of service area
Pipe length
1925
1935
1945
1955
1965
1975
1985
1995
Year

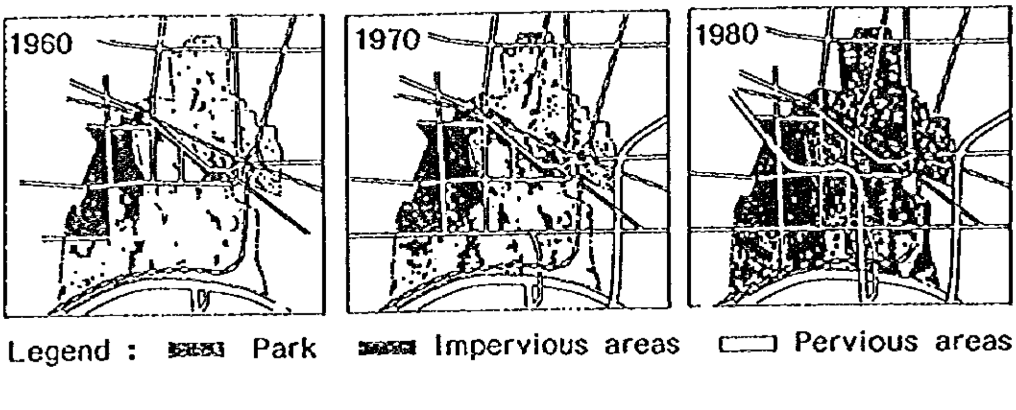
Flooding Area ('79 ~ '90)



Total number of floods : 78

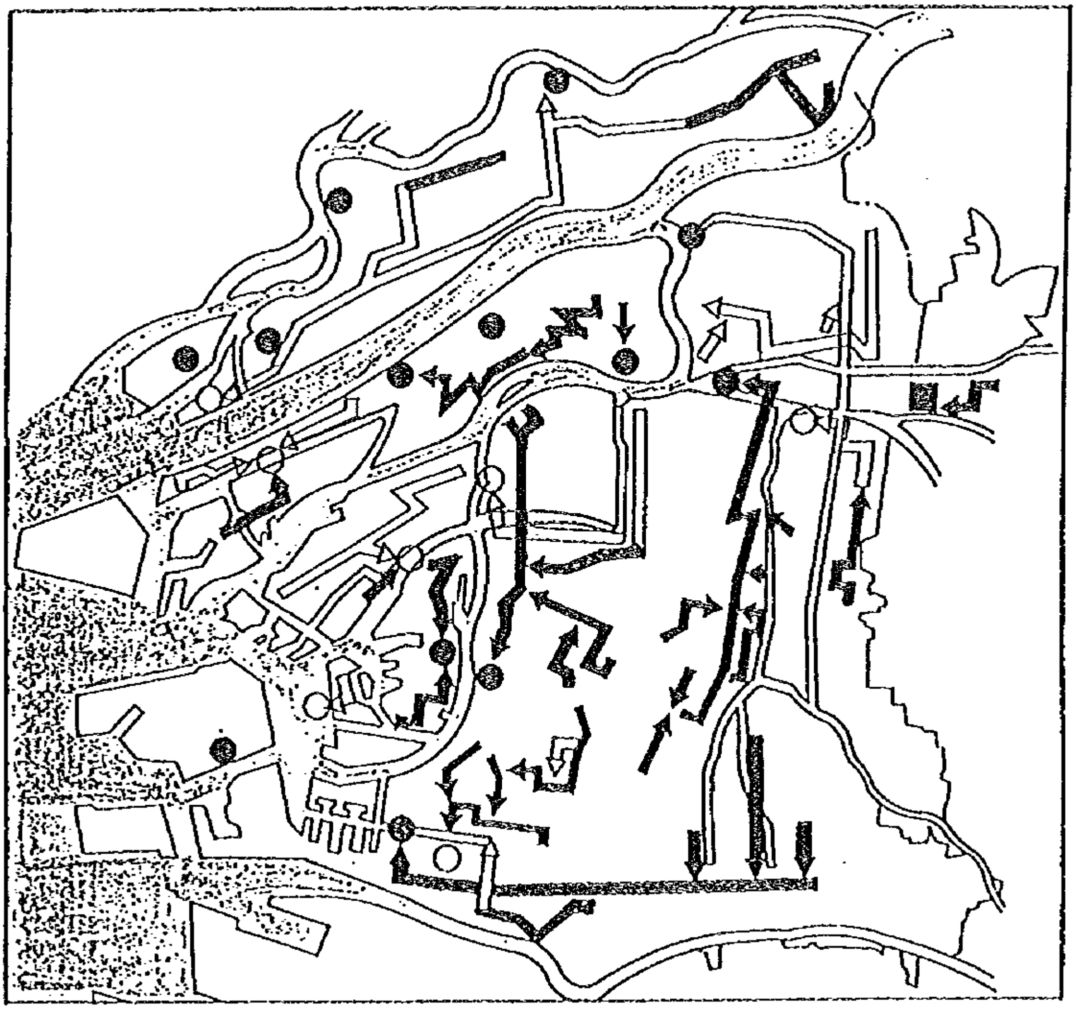
Total flooding houses : 114,000

Change in land use of Hirano Public Sewerage·Area



Legend : Park Impervious areas Pervious areas

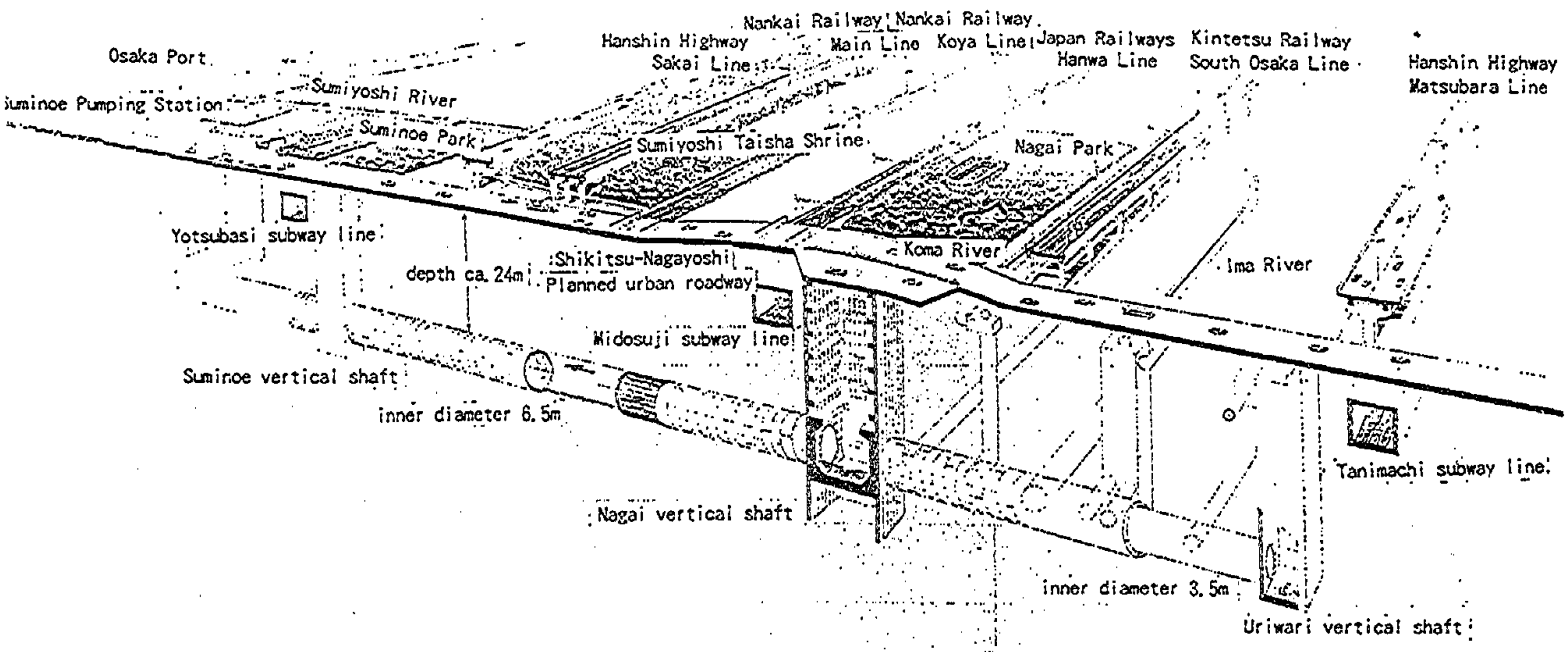
LOCATION OF MAJOR FACILITIES



←▬▬	Supplementary trunk sewer
■	Reservoir
●	Pumping station

Regend:■:Under Construction or Operation

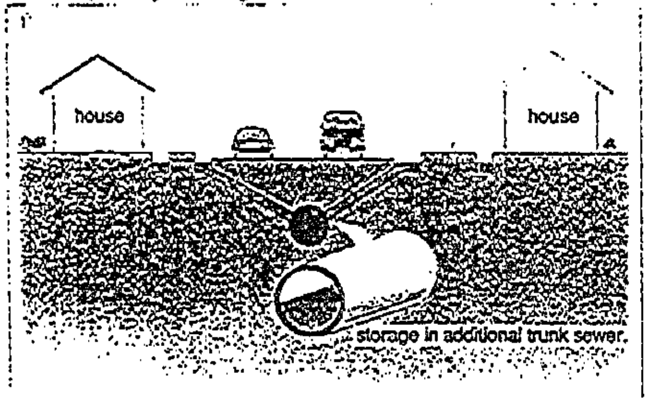
Fig 12　□:Planning


Osaka Port
Suminoe Pumping Station
Sumiyoshi River
Suminoe Park
Hanshin Highway
Sakai Line
Nankai Railway
Main Line
Nankai Railway
Koya Line
Japan Railways
Hanwa Line
Kintetsu Railway
South Osaka Line
Hanshin Highway
Matsubara Line
Sumiyoshi Taisha Shrine
Nagai Park
Yotsubasi subway line
depth ca. 24m
Shikitsu-Nagayoshi
Planned urban roadway
Koma River
Ima River
Midosuji subway line
Suminoe vertical shaft
inner diameter 6.5m
Nagai vertical shaft
Tanimachi subway line
inner diameter 3.5m
Uriwari vertical shaft

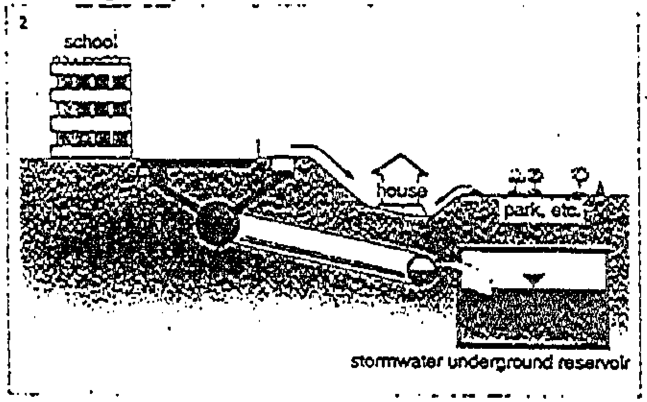
Localized Flood Control

It takes a long time for the preparation of stormwater drainage facilities. So in order to reduce flood damage as quickly as possible, localized measures will be taken as follows:

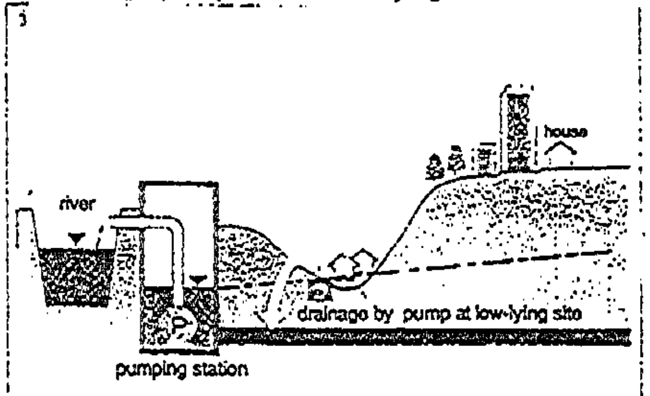
1. Temporary storage in additional trunk sewers.



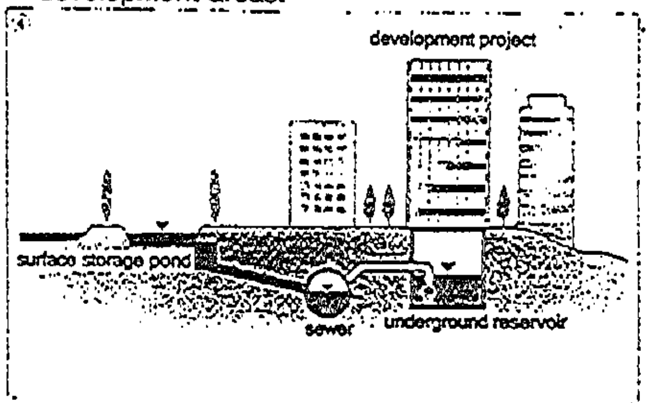
2. Storage at public sites



3. Drainage pump at local low-lying sites

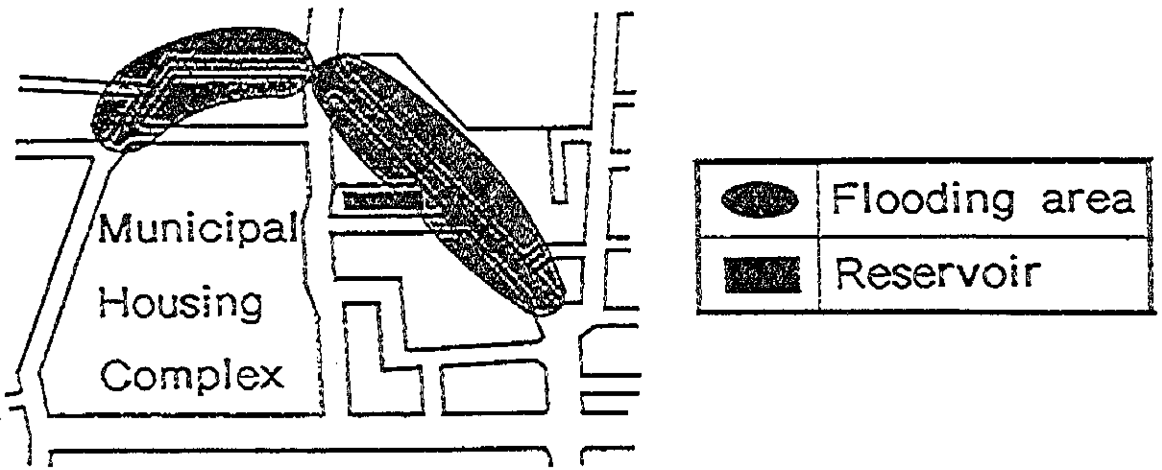


4. Control of rainwater runoff at public sites and development areas.

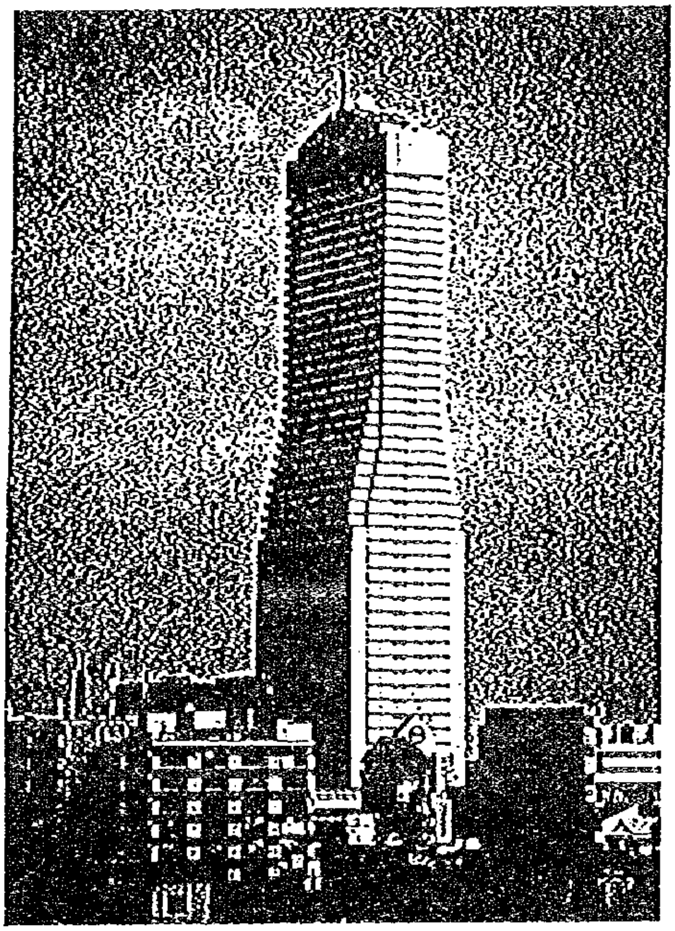


Small-scale reservoir

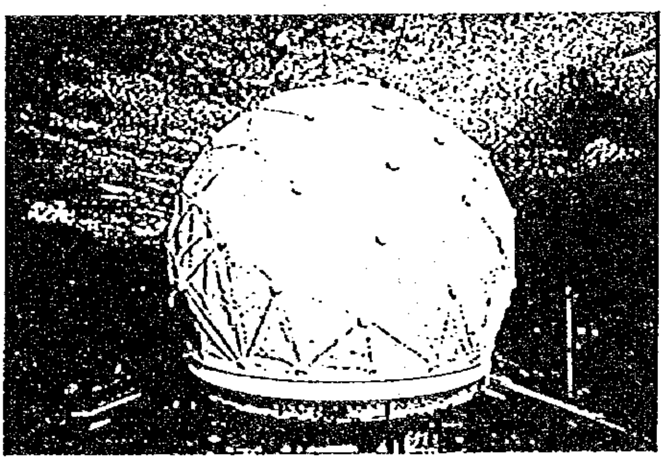
Neighboring sketch



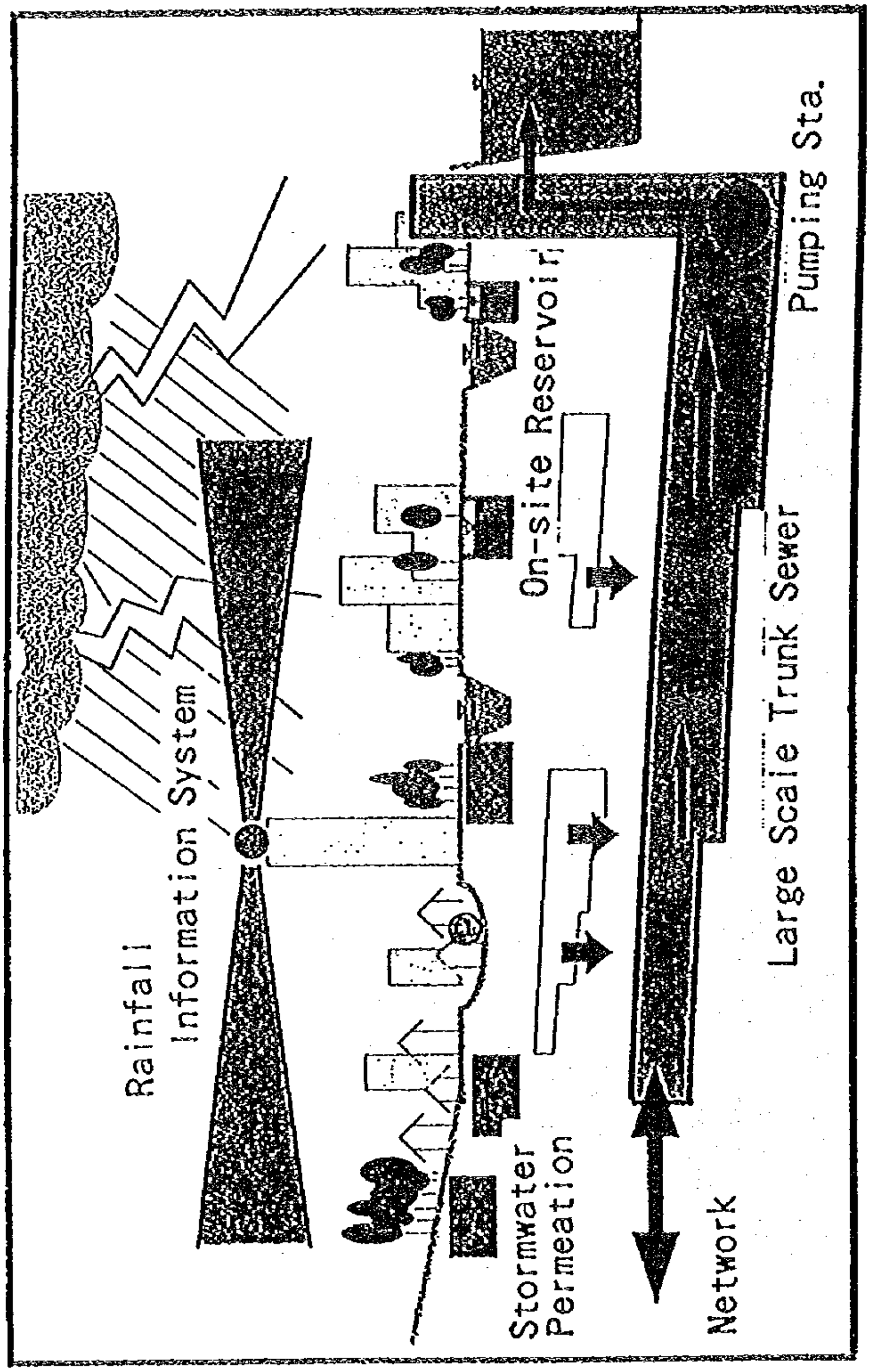
Rainfall Radar, Used Exclusively for Sewerage Operation



A radar installation on the roof of a 200 m-high building



A radar cover


Rainfall
Information System
Stormwater
Permeation
On-site Reservoir
Pumping Sta.
Large Scale Trunk Sewer
Network

Osaka City Waste Treatment

Toru Takagi
Promotion Officer
General Affairs Section
Osaka Environmental Management Bureau

[Introduction]

Long a center of Japanese commerce, Osaka City, which ranks second only to Tokyo politically and economically, is located in approximately the center of Japan at longitude 34° and latitude 134°.
Encompassing an area of $220km^2$, the city is densely populated being home to 2.6 million people at night and swelling to 4 million people during the day.
With the exception of its western side which borders on Osaka Bay, Osaka City is surrounded to the north, south, and east by other cities. The absence of mountainous areas means that it is almost 100% urbanized.
Of the 270,000 businesses in the area, approximately 70% are tertiary industries, such as retail or service industries, etc., with manufacturing accounting for 15% and less than 0.1% of the population being engaged in agriculture, forestry, and fishing.
The Osaka City Environmental Management Bureau is responsible for overseeing the disposal of waste resulting from the lively activities of the city.

[An Outline of Waste Treatment]

In Japan, waste treatment is regulated by the Waste Disposal and Public Cleansing Law. Under the provisions of this law, waste is classified as either General Waste or Industrial Waste.
Local governments are required to make disposal plans for general waste, which includes the treatment and disposal of refuse discharged by ordinary households and shops. On the other hand, industrial waste discharged as a result of business activities is referred to in 20 categories as stipulated by the law and the enterpriser is responsible for the appropriate treatment of such.
The Osaka City Environmental Management Bureau provides necessary regulations and guidance for the collection, treatment, and disposal of general waste and the appropriate treatment of industrial waste.
There are two routes for the treatment of general waste in Osaka City. The first route is through Osaka City which collects, treats and disposes of waste directly, while the second is through enterprisers licensed by Osaka City which collect waste.
Most of the waste collected directly by Osaka City is refuse discharged from ordinary households, while licensed enterprisers mostly collect general waste discharged from arcades and shops at night and early in the morning.
Basically, Osaka City constructs, maintains, and manages waste treatment and disposal facilities, with combustible refuse being incinerated hygienically at incineration plants while incombustible waste and incineration ash is disposed of in landfills. In Japan, which has only a limited land area, incineration is the main method of waste treatment.

[Changes in the Volume and Quality of Refuse]

Despite the fact that Osaka City's population has remained stable, the volume of refuse discharged has continued to increase since around 1950. The amount of general refuse discharged by businesses has increased more than that discharged from ordinary households.
On the other hand, changes have been seen in the components of refuse accompanying diversification in the lifestyles of residents, with the proportion of paper and plastics greatly increasing.
In recent years, recycling activities have been promoted throughout Japan and measures have been taken to recycle resources, such as empty bottles and cans, etc. The collection and recycling of PET (polyethylene terephthalate resin) bottles is scheduled to start in Osaka City from October 1997, in accordance with the "Container and Wrapping Recycling Law" which was implemented in April 1997.

[Stages of Refuse Treatment]

We will next look at the various stages of refuse treatment in Osaka City. The annual total volume of general waste discharged by residents and enterprises in Osaka City amounts to 2.14 million tons. This refuse is divided into three categories.
The first is refuse discharged from ordinary households, which amounts to approximately 740,000 tons per year. This is classified as domestic refuse, bulky refuse/irregular refuse (discharged when shifting house etc.), and recyclable resource refuse, such as bottles and cans, etc.
The second is ordinary refuse discharged from shops and business establishments, which amounts to 1.37 million tons per year.
The third is refuse from public space cleansing, such as that resulting from the cleansing of roads and waterways and from illegal dumping, which amounts to 30,000 tons per year.
This waste is collected by Osaka City vehicles or licensed enterprisers, and combustible items are taken to incineration plants at 10 different locations around the city. The volume of such refuse amounts to approximately 1.8 million tons per year. The ash from these incineration plants, which amounts to approximately 50,000 tons per year, and incombustible waste, which amounts to approximately 27,000 tons per year, is taken to either an offshore landfill site in Osaka City's Konohana Ward, or disposed of in other offshore landfills created under the "Osaka Bay Phoenix Plan".
Recyclable resource refuse, such as empty cans and bottles, etc., is taken to resource sorting facilities where it is sorted and compressed, after which it is recycled at private facilities.

1. Collection of Domestic Refuse

Refuse from the approximately 1 million households, etc. in the city is collected directly by Osaka City twice a week on specified days using a fleet of 439 press-dump trucks and 181 light trucks. The annual volume of refuse collected is approximately 620,000 tons (up to 10kg per household may be discharged daily free of charge).
In order for such activities to be carried out efficiently, the city is divided into 10 blocks with a branch office of the Environmental Management Bureau located in each. Each branch office is responsible for making their own collection plans for their particular ward.
In certain areas of the city, a Pneumatic Waste Conveying System is being introduced whereby refuse is dropped into a pipe and transported by the air flow to collection points. This system is used in two areas of the city and services approximately 12,000 households. The annual volume of refuse collected in this way is approximately 20,000 tons.

2. Collection of Bulky Refuse

Bulky refuse from households, such as superfluous furniture and consumer appliances, are collected directly by Osaka City 12 times a year on certain days (basically once a month) by a fleet of 75 press-dump trucks and 33 ordinary trucks. The annual volume of bulky refuse collected amounts to approximately 80,000 tons.

3. Collection of Irregular Refuse

When large amounts of refuse are generated due to house-moving or other events, this is collected by the branch offices of the Environmental Management Bureau at a rate of 1,200 yen for each 50kg. The annual volume of refuse collected in this way amounts to approximately 9,000 tons.

4. Collection of Recyclable Resources

Since October 1994, in addition to empty cans and bottles, other resource refuse, such as metal cookware like pots, etc., has been collected from households in all areas of the city. This is collected by a fleet of 62 packer vehicles and 23 light trucks.

5. Collection of Business-related Refuse

General waste collectors licensed by the city (390 enterprisers) collect refuse on individual contracts from areas where large volumes of refuse are discharged, such as companies, shops, markets, and arcades, etc., and areas from which refuse must be collected at night or early in the morning. The annual volume of such refuse collected amounts to approximately 1.23 million tons.

6. Disposal of Carried-in Refuse

When large volumes of refuse or soil and sand are treated privately, after completing the appropriate paperwork at one of the 10 branch offices of the Environmental Management Bureau, this may be taken to the city's treatment facilities at a rate of 58 yen for each 10kg. The annual volume of refuse treated amounts to approximately 150,000 tons.

7. Street Cleansing

Road sweepers are used by contractors to clean the 675km of roads and pedestrian bridges, etc. in the city as frequently as once a day through to once every two weeks. This is carried out at night with consideration being given to the state of traffic flow, etc. Cleansing is carried out by hand in places such as footbridges and the footpaths of bridges, etc. for which it is difficult to obtain the cooperation of residents.
Beautification Squads consisting of women staff, which patrol the city daily, clean areas where scattered refuse, such as empty cans and scraps of paper, etc., is an eyesore. The annual volume of such refuse collected amounts to approximately 9,000 tons.

8. Collection of Waste in Public Trash Receptacles

Trash receptacles and ash trays are located in approximately 4,000 places around the city near main railway terminals, such as Osaka, Namba, and Tennoji stations, alongside major roads, and near bus stops, etc. The annual volume of such refuse collected amounts to approximately 2,000 tons.

9. Disposal of Illegally Dumped Refuse

In addition to quickly removing refuse dropped on roads, patrols are carried out in order to prevent illegal dumping. The annual volume of such refuse collected amounts to approximately 12,000 tons.

10. Cleansing of Waterways

Refuse floating in any of the 10 waterways which flow through Osaka City (27.7km), such as the Tosabori River and the No.2 Neya River, is collected by cleansing vessels. The volume of refuse collected from waterways amounts to approximately 6,000 tons.

[Pneumatic Waste Conveying System]

The Pneumatic Conveying System involves the creation of an airflow within underground pipes which transports the refuse from each household to an incineration plant or relay point, somewhat like a huge vacuum cleaner.
This system was introduced for the first time in Japan as a method of collecting refuse in two areas of high-rise apartments in Osaka City which house approximately 30,000 households.

[Intermediate Treatment]

Although forms of intermediate treatment include incineration, crushing, shredding, and high-speed composting, etc., due to a lack of adequate implementation of resource recycling technology, it is thought that incineration is better than other methods of treatment due to the fact that it prevents harmful insects and offensive odor, and reduces volume and weight.
In order to effectively utilize the limited number of landfills, incineration was thought to be the best method as it allows refuse to be reduced to approximately a quarter of its initial volume, and approximately one fifteenth of its initial volume. Therefore, efforts were made to construct incineration facilities, with the Taisho plant being completed in 1980.
However, the amount of refuse discharged continued to rise after that and due to the aging of facilities,

reconstruction of facilities is being carried out as is necessary.
With regard to the treatment of bulky refuse, a crushing facility, which was constructed in 1988, crushes the refuse, after which combustible refuse is incinerated and incombustible refuse is taken to landfills.

[Refuse Incineration Plants]

Since the completion of the tenth plant in Taisho in 1980, combustible refuse has all been incinerated at incineration plants. However, older plants are showing signs of aging and incineration efficiency is declining due to increases in the volume of refuse and changes in the quality of refuse. Therefore, reconstruction activities are being encouraged.
We will now look at an outline of an incineration plant. The reasons that Osaka City utilizes the incineration method are that it reduces refuse to one fifteenth of its initial size and eliminates offensive odor as such air is used in incineration and burns at high temperatures. In an area as urbanized as Osaka City, incineration treatment is thought to be the most hygienic and efficient method of refuse treatment.

• Treatment of Incineration Plant

1. Refuse Dumping

The collected refuse is drawn through the refuse dumping hatch into the refuse pit. The refuse crane, which is remotely controlled from within the crane control room, transports the refuse stored in the refuse pit to the refuse feeding hopper.

2. Incineration

A drying grate, combustion grate, and burn-out grate are located within the incinerating furnace with each grate consisting of fixed and moveable parts which convey the refuse. Refuse dumped into the hopper is fed into the drying grate in appropriate volumes, after which it is incinerated in the combustion grate, and then moved to the burn-out grate where it turns completely to ash.

3. Incineration Ash

Incineration ash is removed by water sealed conveyor, cooled, and sent to the ash pit where it is temporarily stored before being loaded onto trucks by the ash crane and taken to landfill sites.

4. Air Supply

Air within the refuse pit containing offensive odor is extracted by a forced draft fan, and after being heated by an air preheater, is fed into the incinerator from below each grate.

5. Exhaust Gas and Waste Water Treatment

As exhaust gases keep a high temperature of approximately 850-950°C, after the heat is absorbed in a boiler and the temperature has fallen, particles of soot in the exhaust gas are removed by bag filter. Nitrogen oxides are removed by a selective catalyst reactor after which the exhaust gases are fed through a wet gas scrubber to clean them. This clean gas is then burnt in the gas reheater before it is released from the smokestack.

Wastewater discharged from the plant is purified with the process of coagulating sedimentation and filtration in the wastewater treatment equipment, after which it is discharged into sewerage.

•Pollution Prevention Measures

1. Smoke

Particles of soot contained in the exhaust gas are removed by an electric precipitator or bug filter, while a wet gas scrubber removes hydrogen chloride and sulfur oxides.

An automated combustion control device ensures that the generation of nitrogen oxides is kept at a minimum, while in the most modern plants selective catalyst reactors are being introduced.

2. Offensive Odor

As the air within the sealed refuse pit is extracted by a forced draft fan to be used for combustion purposes in the incinerator furnace, the air pressure in the pit is maintained at a slightly lower pressure than that outside so that even when the hatch is opening to accept more refuse, offensive odor does not escape outside the pit.

3. Wastewater

Wastewater discharged from the plant is divided into plant wastewater of wet gas scrubber. Plant wastewater is treated using the alkali coagulation, and sedimentation methods, while wastewater of wet gas scrubber is treated using the coagulation, sedimentation, filtration, and Kireto resin methods. Wastewater is discharged either into the sewerage system or into waterways.

• Heat Utilization

The latest equipment is used for pollution prevention and to ensure that all treatment is carried out by machine. In addition to using heat produced through incineration for electricity and hot water within the plant, steam is also supplied for power companies or to neighboring facilities depending on the particular facility. Presently, eight of the ten incineration plants in Osaka City supply steam or electricity to other facilities.

[Final Disposal]

Final disposal originally took advantage of the natural reduction capabilities of the soil and in various foreign countries blessed with an abundance of final disposal sites, final disposal of refuse is mainly carried out by disposing of refuse directly in landfills. For a time after World War Two, Osaka City also established small landfills both inside and outside the city in flat bog areas and ponds, however, with the increase in urbanization within the city and the increased number of residential areas in surrounding cities, it became extremely difficult to construct landfills on land. Therefore, in 1972, a large disposal site was established in Osaka Bay.

•North Port Disposal Site

Both incombustible (approximately 260,000 tons per year) and incineration ash (approximately 500,000 tons per year) must be disposed. The final destination of all refuse is the landfills.

In Osaka City, presently, 730,000m^2 of the North Port Disposal Site (Maishima) in Konohana Ward, which has a total area of 2.88 million m^2, is used as a landfill. A portion of incineration ash is also being used in the landfill sites in the Osaka Bay Phoenix Project. However, it is considered that the securing of the next disposal site for use after these disposal sites are full is becoming increasingly difficult. Therefore, the present sites must be utilized for as long as possible.

•An Outline of Landfill Operations

1. Incombustible waste and incineration ash transported by refuse collection vehicles is loaded onto barges at the North Port relay station and transported to the reclamation site.

2. The barges are covered with sheets to prevent the refuse from being scattered by the wind.

3. At the disposal site, a crane is used to remove the refuse from the barges and transfer it to trucks.

4. 50cm of soil is used to cover every 3m of refuse.

•Pollution Prevention Measures

1. Floating aerators are used within the landfill site to treat contaminated water produced through putting the waste into the landfill. Coagulation/deposition devices are also used to achieve a higher level of processing.

2. The sandwich method is used to cover refuse with soil in areas that have formed into land, and gas removal equipment removes the methane gas, etc. that is generated.

3. In order to prevent the outbreak of harmful insects, soil is used to appropriately cover refuse to prevent them from fully developing.

[Refuse Volume Reduction and Recycling]

In recent years, the volume of refuse generated has increased throughout the country, and the securing of treatment and disposal facilities to appropriately treat this increasing amount of refuse is becoming a serious problem.
On the other hand, from the viewpoint of global environment protection and the effective use of resources, there is a pressing need for the city to reduce the total amount of waste by the restriction of refuse discharge and the recycling of discharged refuse.
Even in Osaka City, efforts have been made to educate residents regarding refuse volume reduction and recycling. Since October 1993, after carrying out tests over the period of one year, empty cans and bottles are now being separately collected in all areas. From October 1997, with the promulgation of the Container and Wrapping Recycling Law, the collection of PET bottles is also scheduled.

[Recycling of Empty Cans and Bottles]

Empty cans and bottles which have been collected by a special recyclable resource refuse collection vehicle are taken to the Resource Sorting Facility where they are sorted. After that they are recycled as raw materials, such as aluminum and steel, etc.

•Acceptance of Paper Packs by Public Facilities, etc.

Paper packs, such as paper milk packs, etc. are accepted at the 10 branch offices of the Environmental Management Bureau, etc.

•Loaning of Machines to Citizen Groups and Shops

Machines, such as can crushing machines, etc. are being loaned to citizen groups and supermarkets, etc. in order to support the recyclable resource collection activities of citizens who are doing so of their own initiative. After collection, the recyclable resource refuse is sold to recycle resource enterprisers by such groups.

• Recycling Monthly Magazine

In order to effectively use furniture and consumer appliances, etc. which have become unnecessary to residents, "Osaka Recycling Monthly" a monthly disused item magazine, has been published since 1991. 50,000 copies are published every month which are available at Ward Offices and public facilities throughout the city.

• Waste that Poses Difficulties in Disposal

Dangerous goods and items which are difficult to dispose of are also among refuse and hinder the smooth treatment of such. Therefore, in addition to requesting that residents do not dispose of such as refuse, the cooperation of related industries is being sought with regard to the collection of such items.
In March 1994, the state designated the following four items as items which are difficult to dispose of:
* Waste rubber tires

* Waste electric refrigerators (of more than 250-liters)
* Waste televisions (larger than 25-inch)
* Waste spring mattresses

Osaka City has begun to work on related industries with the aim of establishing a system for the appropriate treatment of these items. Although not designated by the state, guidance regarding fire extinguishers, gas canisters, and waste batteries will also being strengthened.

[Beautification Promotion Activities]

In addition to initiating environmental maintenance activities, such as road cleansing and the treatment of illegally dumped refuse, etc., Osaka City is also calling for a stop to the throwing away of cigarette butts and cooperation in order to promote the creation of a clean and beautiful city.
Further, in order to promote the overall beautification of the city, various activities are being carried out by the Osaka City Environmental Beautification Promotion Headquarters, which is an organization functioning within the City Office, in order to heighten the awareness of residents.
Since November 1996, an ordinance to prevent the throwing away of empty cans, etc. was enacted to further promote the beautification of the city.
In 1991, the No Littering Leaders were formed, which is a group of senior citizens living in the city that carry out beautification awareness activities on major roads and at terminals etc. on a daily basis.
As a result, littering has been reduced from 40% to 20% since these activities were commenced.
In addition, there are approximately 600 volunteer clean-up groups which cooperate with clean-up activities on a once a week through to once a month basis. Osaka City supplies these groups with cleansing tools, such as brooms and dust pans, etc.

[Conclusion]

Let us now take a look at the problems facing waste treatment in Osaka City, together with future trends.

1. Refuse Collection

Despite the fact that Osaka City is one of the smallest of Japan's large cities in terms of actual land area, business activities—especially among service industries—are extremely active. As a result, traffic congestion hinders the efficient use of refuse collection vehicles in the heart of the city. In an effort to overcome this, a pneumatic waste conveying system was introduced in parts of the city on a trial basis, however, the implementation of this system on a city-wide basis is not thought to be economically viable.

2. Treatment and Disposal

Inland landfills were used for the disposal of refuse in Osaka City since approximately 1950, however, with increased urbanization it became increasingly difficult to secure new sites for this purpose. Therefore, incineration plants were introduced in an effort to reduce the massive amount of refuse and to utilize present landfills for as long as possible. Ahead of other areas in Japan, the first mechanized incineration plant was constructed in Osaka in 1963, and with the completion of the Taisho Plant in 1980, it became possible to incinerate all combustible refuse in the area. However, although it is necessary to reconstruct aging plants in order to cope with the ever increasing volume of refuse, the securing of new land for landfills and new incineration plants is becoming increasingly difficult in a city that is so urbanized.
It is also incredibly expensive to construct and maintain pollution control facilities for the removal of harmful gases produced at the time of incineration.

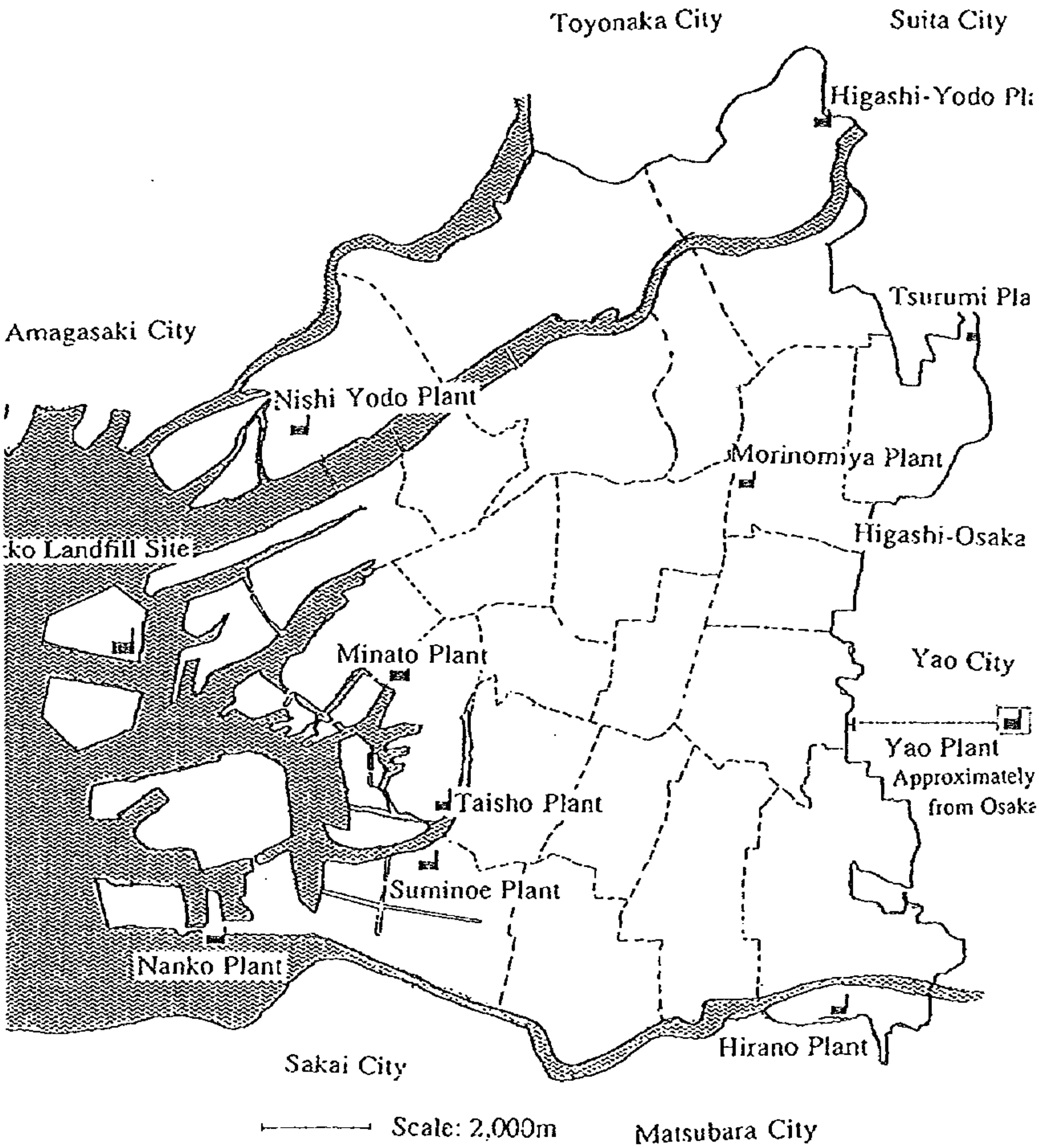
3. Future Challenges

Waste treatment measures in a city that has reached such a major state of urbanization face various problems at every stage of the collection, transportation, treatment, and disposal process. Therefore adequate consideration needs to be given to increase future transportation efficiency and to ensure that treatment and disposal can be efficiently carried out. The question of how to reduce the overall volume of refuse requiring treatment is also a major challenge. Due to increasing diversification in the quality of waste in the city and the fact that there are many kinds of refuse mixed together, there is a limit to the kind of sorting that can be achieved.

In post-war Japan, product development was promoted on the understanding that if large volumes of products were manufactured, the people would consume large volumes of products. This system of economic development stirred up a new consumer awareness. However, that awareness birthed a "disposable" culture which led to the trend where if a new product is released, the old one is thrown away despite the fact that it is probably still perfectly usable. Even in consumer appliances, with new models appearing every year it is cheaper to buy a new item rather than to have the old one repaired after using it for 10 years. Even if people desire to repair their old appliances, there is still the problem of no parts being available. If we go to the supermarket, we see beautifully wrapped fish and meat in convenient containers which we are obliged to purchase despite the fact that they will become refuse. As a result, 60% of all refuse is accounted for by plastic containers, such as trays, etc.

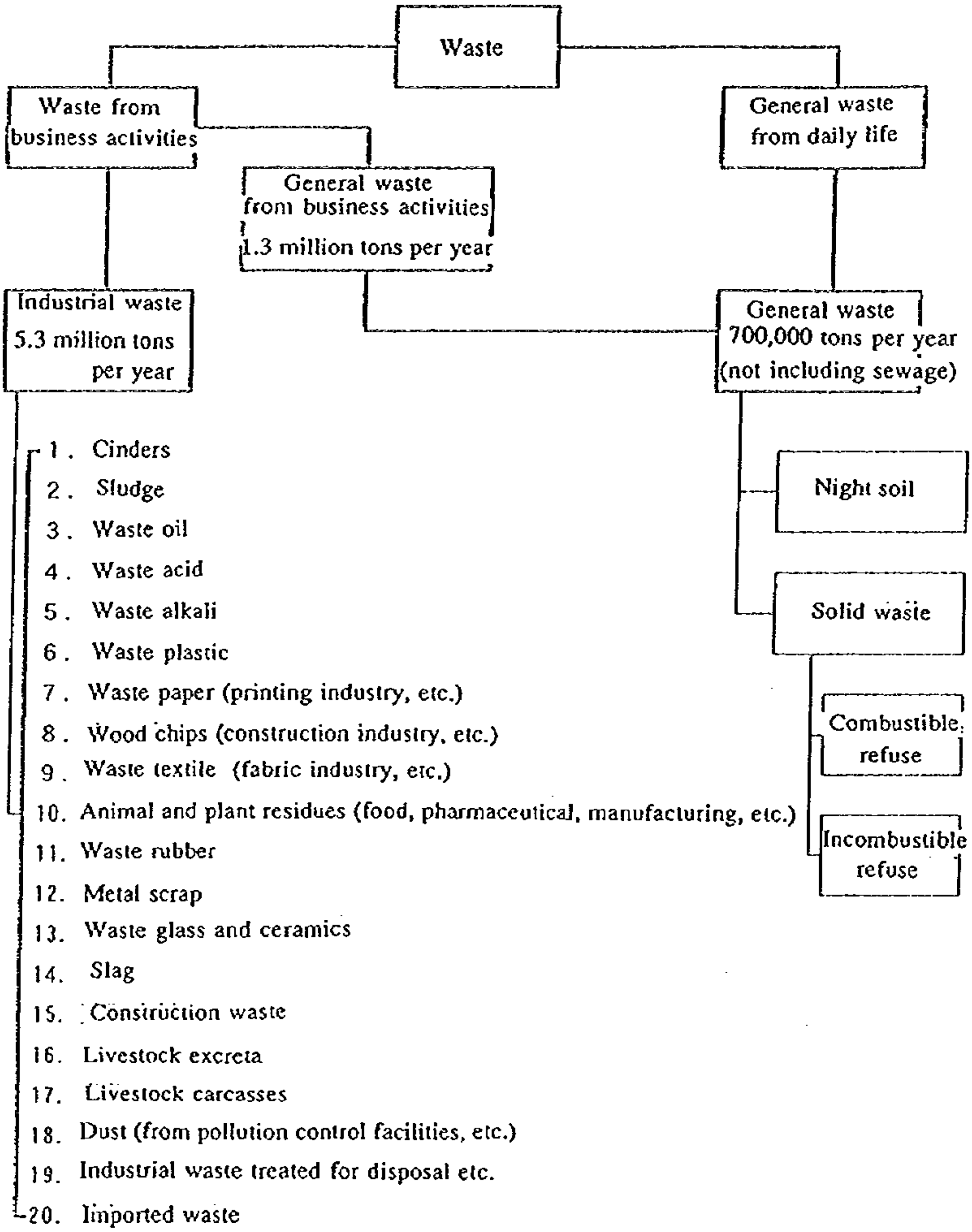
What is necessary for us now is to endeavor to change our "disposable culture" lifestyle in order to create a better living environment, even if that means sacrificing a certain level of convenience.

Map Showing the Location of Incineration Plants

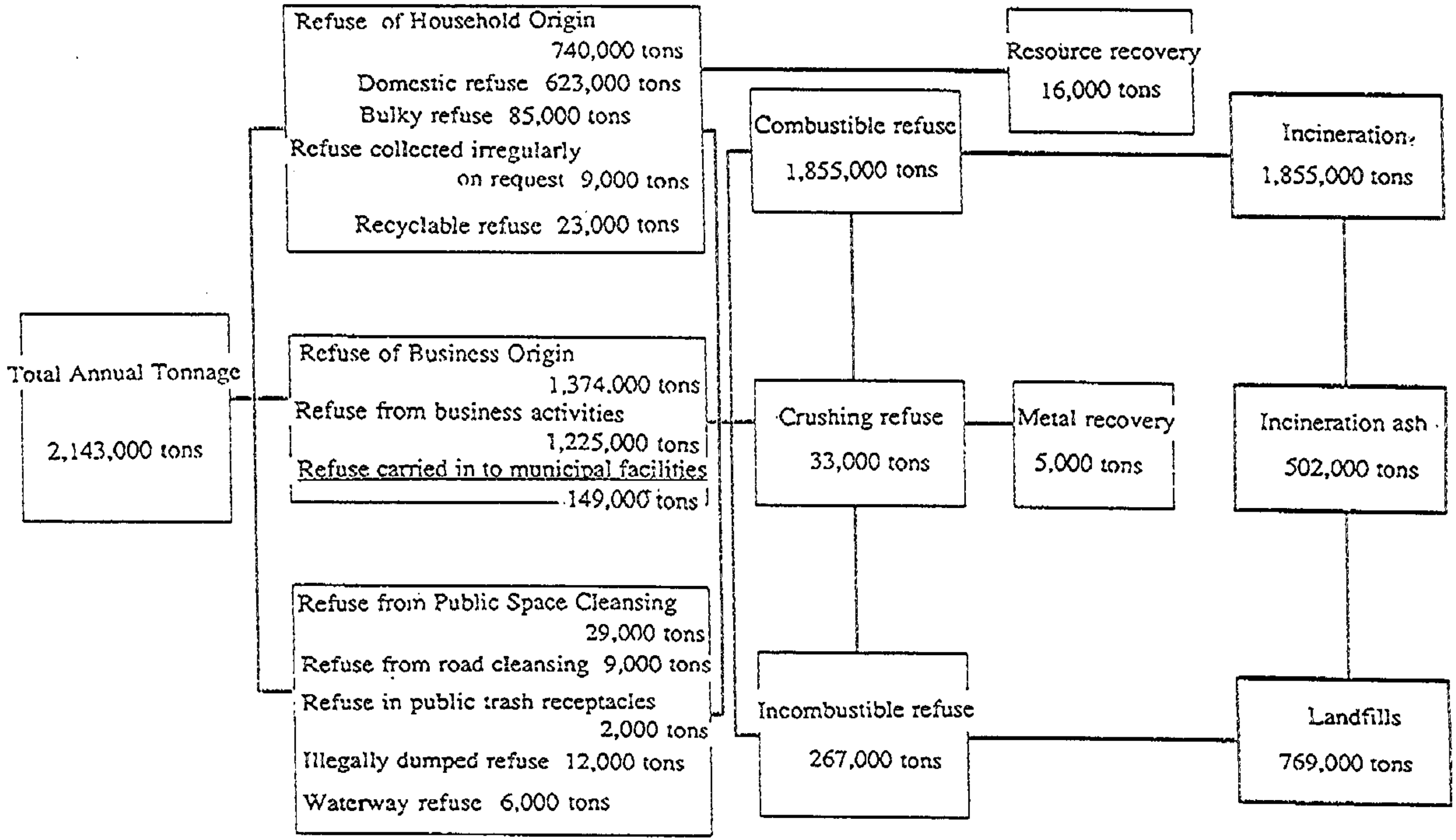


Classification of Waste in Japan

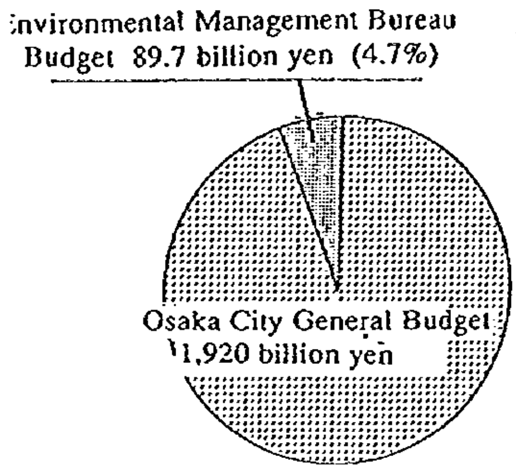
In Japan, in accordance with the Law regarding Waste Treatment and Beautification, waste is classified into general waste and industrial waste.

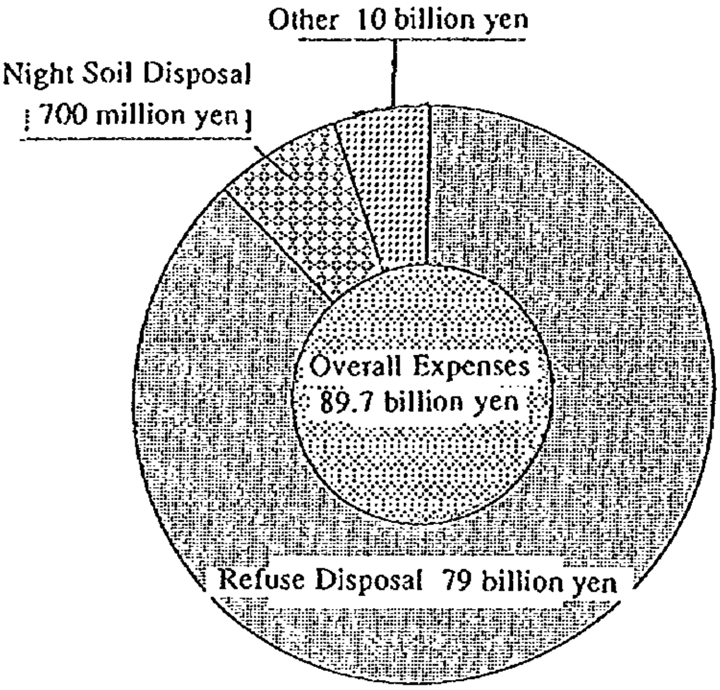


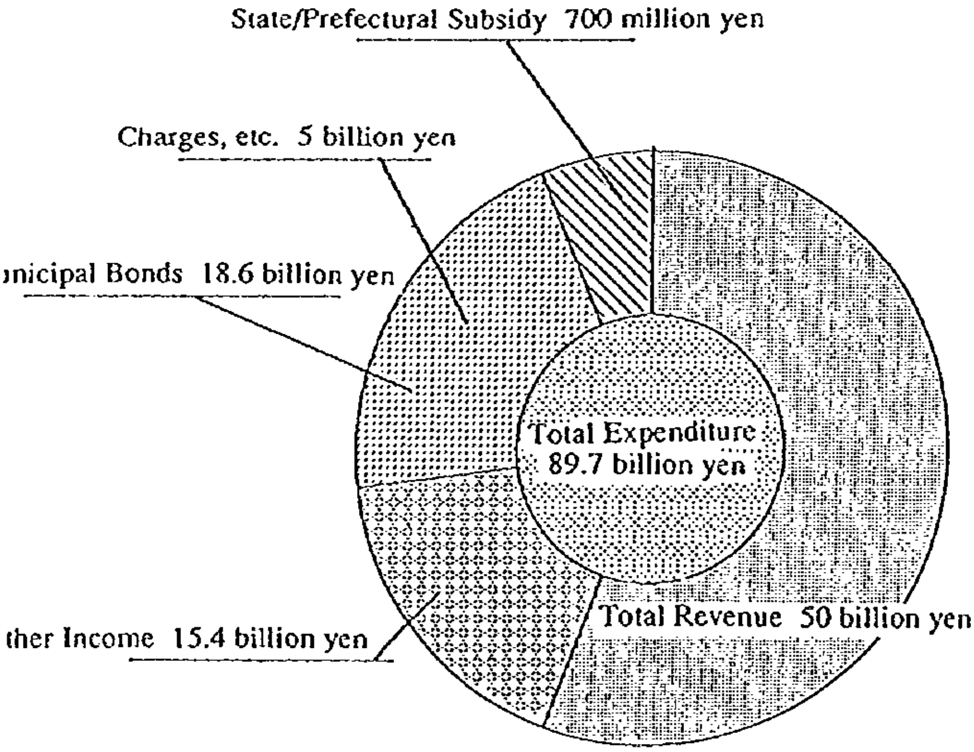
Destination of Waste



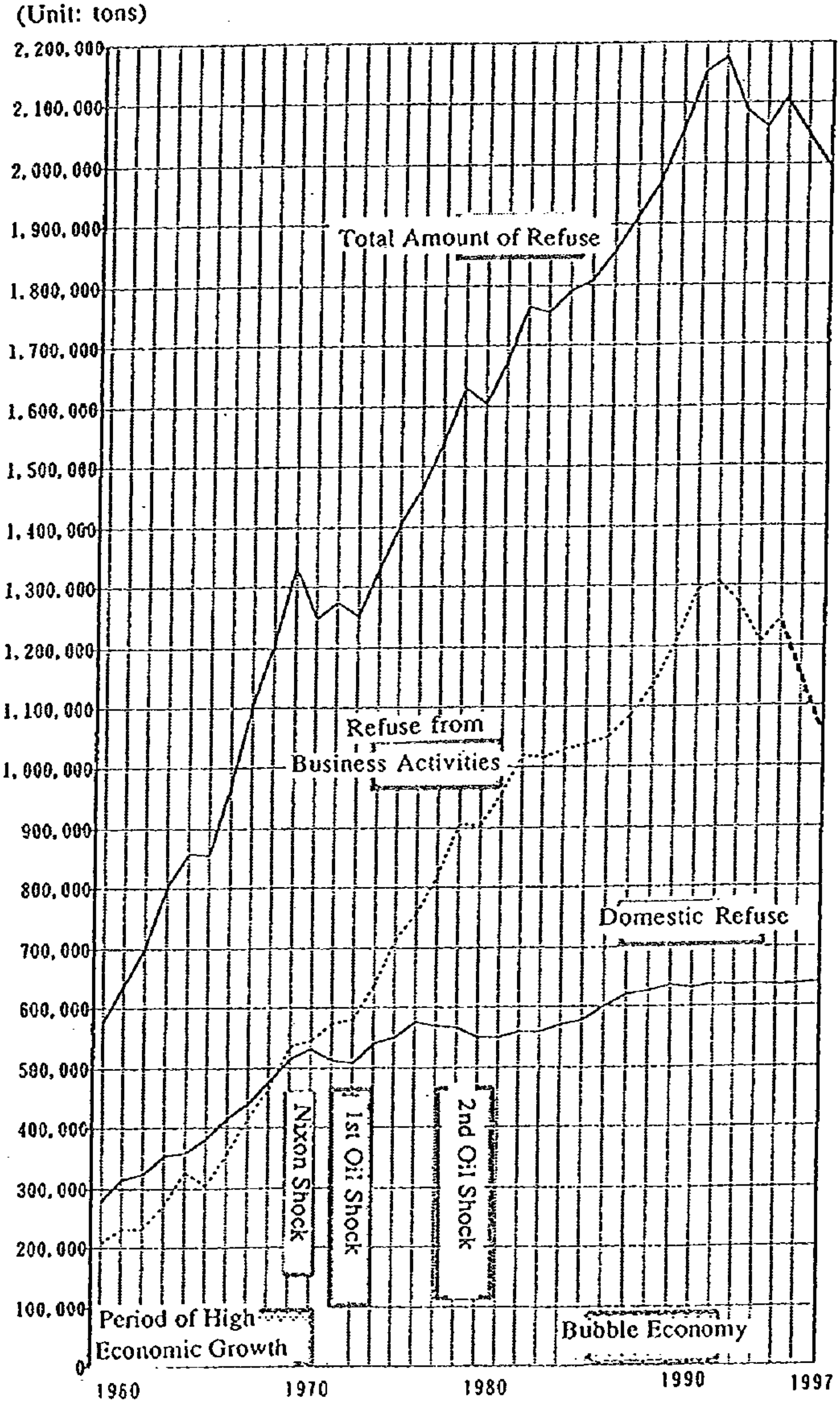
FY1996 Environmental Management Bureau Budget







Change in Amount of Waste (1960-1997)



Change in Waste Composition

	Category	1960	1965	1970	1975	1980	1985	1990	1991	1992	1993	1994	1995
Combustible Waste	Garbage	8.2	14.5	11.8	12.1	13.2	11.5	4.9	5.3	4.9	4.0	8.2	7.5
	Paper	30.1	39.6	28.6	36.8	37.1	28.8	41.1	43.1	40.5	38.2	42.7	35.1
	Textile	4.7	2.9	3.9	5.1	4.0	5.3	5.4	4.0	7.6	5.6	3.8	4.3
	Wood/Bamboo	7.2	4.2	3.4	4.2	2.5	5.6	6.1	7.7	5.5	9.3	6.3	6.9
	Plastics	1.9	3.3	12.2	11.0	15.2	14.3	19.6	18.6	19.0	17.1	16.6	15.2
	Other	6.7	4.9	3.4	2.6	2.8	1.9	7.2	9.4	8.7	9.5	8.3	14.7
	Subtotal	58.8	69.4	63.3	71.8	74.8	67.4	84.3	88.1	86.2	83.7	85.9	83.7
Incombustible Waste	Shells	1.9	2.9	4.0	1.5	1.4	0.9	5.5	4.7	4.0	5.7	5.9	6.1
	Soil and Sand	19.4	9.1	6.2	8.6	6.0	10.1	4.1	2.6	2.5	4.6	1.5	3.8
	Glass, etc.	17.6	15.5	19.3	12.0	12.3	14.8	4.4	3.4	5.3	4.5	4.9	4.2
	Metals	2.3	3.1	7.2	6.1	5.5	6.8	1.8	1.3	2.0	1.5	1.8	2.2
	Subtotal	41.2	30.6	36.7	28.2	25.2	32.6	15.8	12.0	13.8	16.3	14.1	16.3

Change in Waste Components' Calorific Value

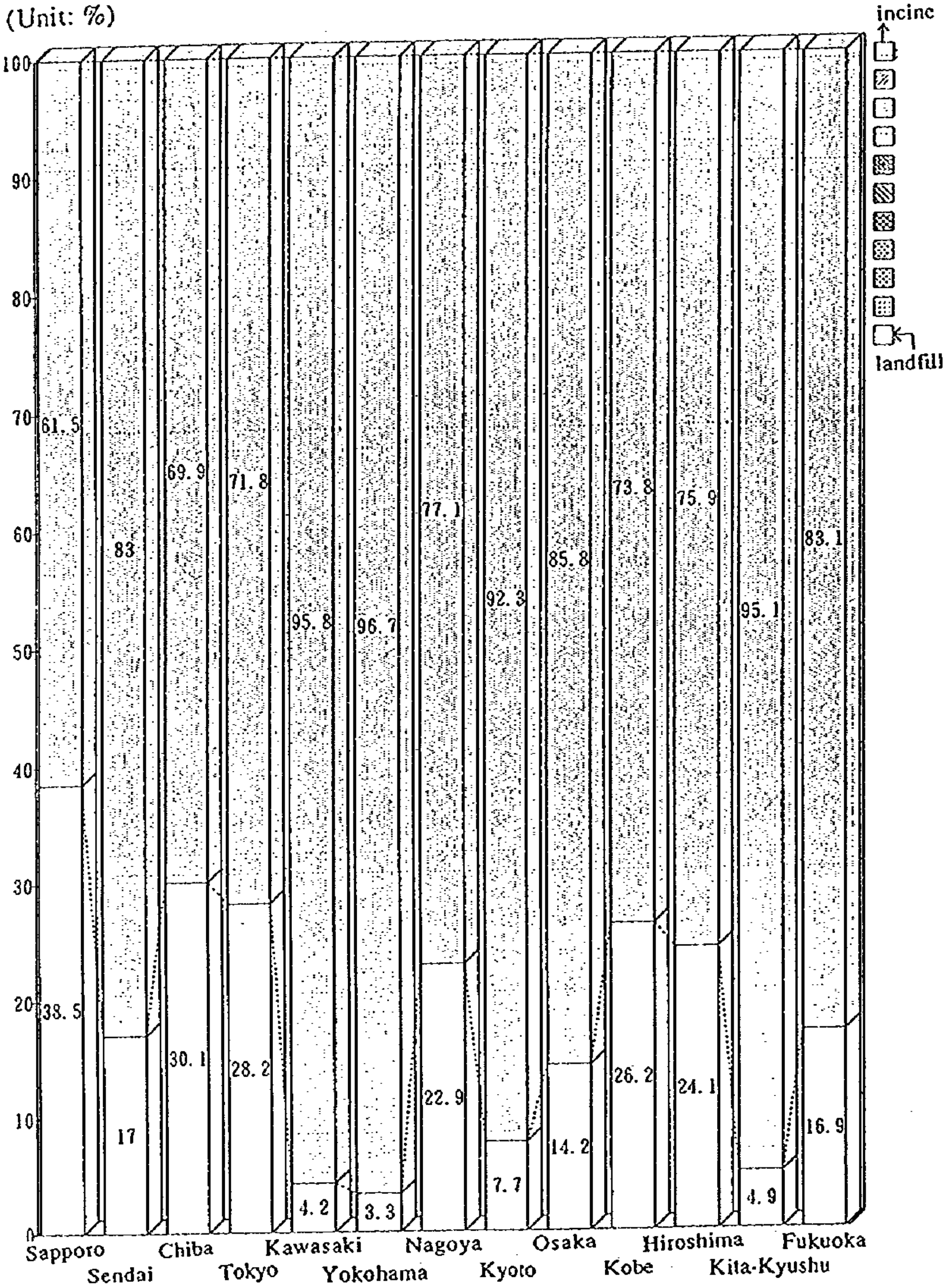
Component	1960	1965	1970	1975	1980	1985	1990	1991	1992	1993	1994	1995
Moisture %	48.2	50.4	50.7	51.5	49.7	40.4	37.9	37.9	35.5	35.0	39.5	38.4
Ash %	22.7	18.7	20.8	15.6	15.5	21.5	16.1	14.8	17.1	18.0	16.3	18.7
Combustible %	29.1	30.9	28.5	32.9	34.8	38.1	46.0	47.3	47.4	47.0	44.2	42.9
Subtotal	100	100	100	100	100	100	100	100	100	100	100	100

Change in Refuse Disposal

Financial Year	Total Volume Treated	Incineration		Landfills		Other	
	t	t	%	t	%	t	%
1955	314,247	44,640	14.2	234,507	74.6	35,100	11.2
1960	437,307	217,422	49.7	211,010	48.3	8,875	2.0
1965	803,462	322,241	40.1	480,980	59.9	241	0.0
1970	1,206,177	712,979	59.1	493,071	40.9	127	0.0
1975	1,330,099	948,981	71.3	25,520	19.2	125,598	9.5
1980	1,604,427	1,269,140	79.1	335,287	20.9	—	
1985	1,808,023	1,472,042	81.4	335,981	18.6	—	
1990	2,152,412	1,765,436	82.0	381,396	17.7	5,580	0.3
1991	2,176,166	1,783,056	81.9	385,389	17.7	7,721	0.4
1992	2,087,013	1,753,406	84.0	326,665	15.7	6,942	0.3
1993	2,062,055	1,811,112	87.8	243,710	11.8	7,233	0.4
1994	2,113,740	1,858,637	87.9	243,726	11.5	11,377	0.6
1995	2,143,452	1,854,753	86.5	267,800	12.5	20,899	1.0

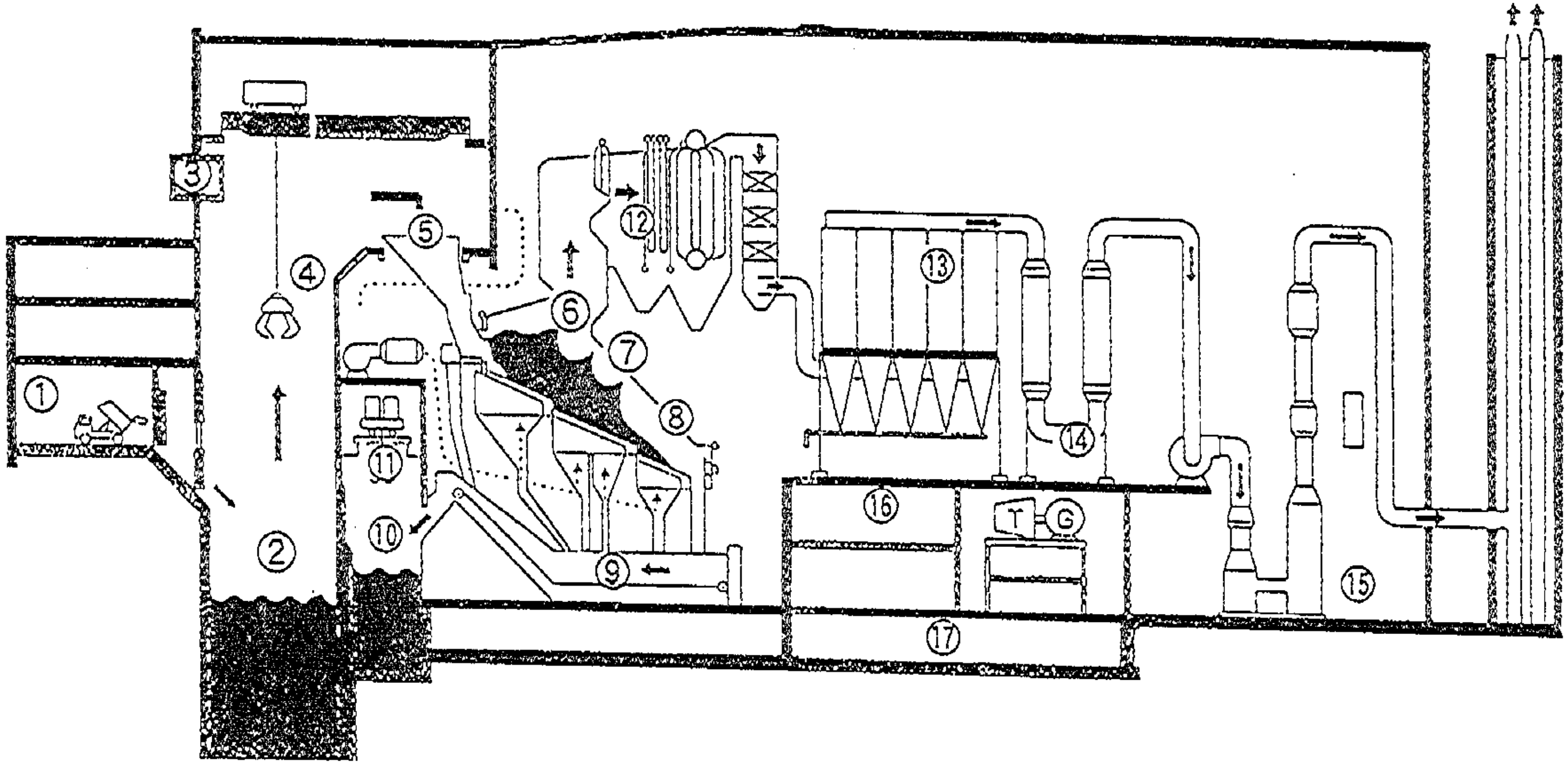
(Unit: tons/%)

The State of Refuse Disposal in 13 Major Cities in Japan



Incineration Plant Overview

① Refuse Pit Hatch	⑥ Drying Grate	⑪ Ash Crane	⑯ Central Control Room
② Refuse Pit	⑦ Combustion Grate	⑫ Boiler	⑰ Wastewater Treatment Equipment
③ Crane Control Room	⑧ Burn-Out Grate	⑬ Bag Filter	
④ Refuse Crane	⑨ Ash Conveyor	⑭ Selective Catalyst Reactor	
⑤ Refuse Feeding Hopper	⑩ Ash Pit	⑮ Wet Gas Scrubber	



THE STRATEGIES AND MEASURES FOR PROMOTING POLLUTION PREVENTION AND CLEANER PRODUCTION BY THE GOVERNMENT AND INDUSTRIES JAPANESE EXPERIENCES

KUNITOSHI SAKURAI, Dr.Eng.
PRESIDENT
TOKYO INTERNATIONAL ENVIRONMENTAL PLANNING INSTITUTE

1. INTRODUCTION

Japan is the only industrialized country in Asia. Therefore it is important to review Japanese CP (cleaner production) experiences with the aim of facilitating other Asian countries to develop and introduce their own CP promotion policies and strategies.

There has been a good deal of progress in industrial pollution prevention and control in Japan over the past 40 years. This is evident from greatly improved air (see Fig.1) and water quality (see Fig.2). As shown in Fig.3 and 4, this improvement has been achieved by CP technologies rather than by EOP (end-of-pipe) technologies, even though practically no explicit CP policy has been adopted by the government.

In addition, process changes for CP purposes have received no favorable treatment from the Japanese government while EOP facilities have enjoyed various favorable treatment measures, including tax reductions and exemptions. After the heavy investment in EOP facilities in the early 1970s to comply with the stringent environmental regulations introduced in 1970, many Japanese enterprises noticed that EOP was too expensive and that CP should be adopted as much as possible to maintain and improve their competitiveness in the market, fulfilling at the same time their responsibility as corporate citizens.

Therefore, the major driving force for the introduction of CP in Japanese industries has been the cost-consciousness of enterprises in the achievement of higher productivity and better compliance with environmental regulations. This means that in the case of Japan, the existence of a "stick," that is, stringent enforcement of environmental regulations, has played the critical role for CP promotion. In addition to the cost-consciousness of enterprises under the influence of that stick, the following can be pointed out as major underlying factors that have facilitated the successful use of CP technologies in Japan.

2. CP PROMOTING FACTORS IN JAPAN

2.1 INTEGRATION OF ENVIRONMENTAL CONCERNS INTO INDUSTRIAL DEVELOPMENT POLICY

Pollution-related organizations in government can be divided roughly into two

Figure 1: Ambient Air Quality Indicators: National Averages 1971–88

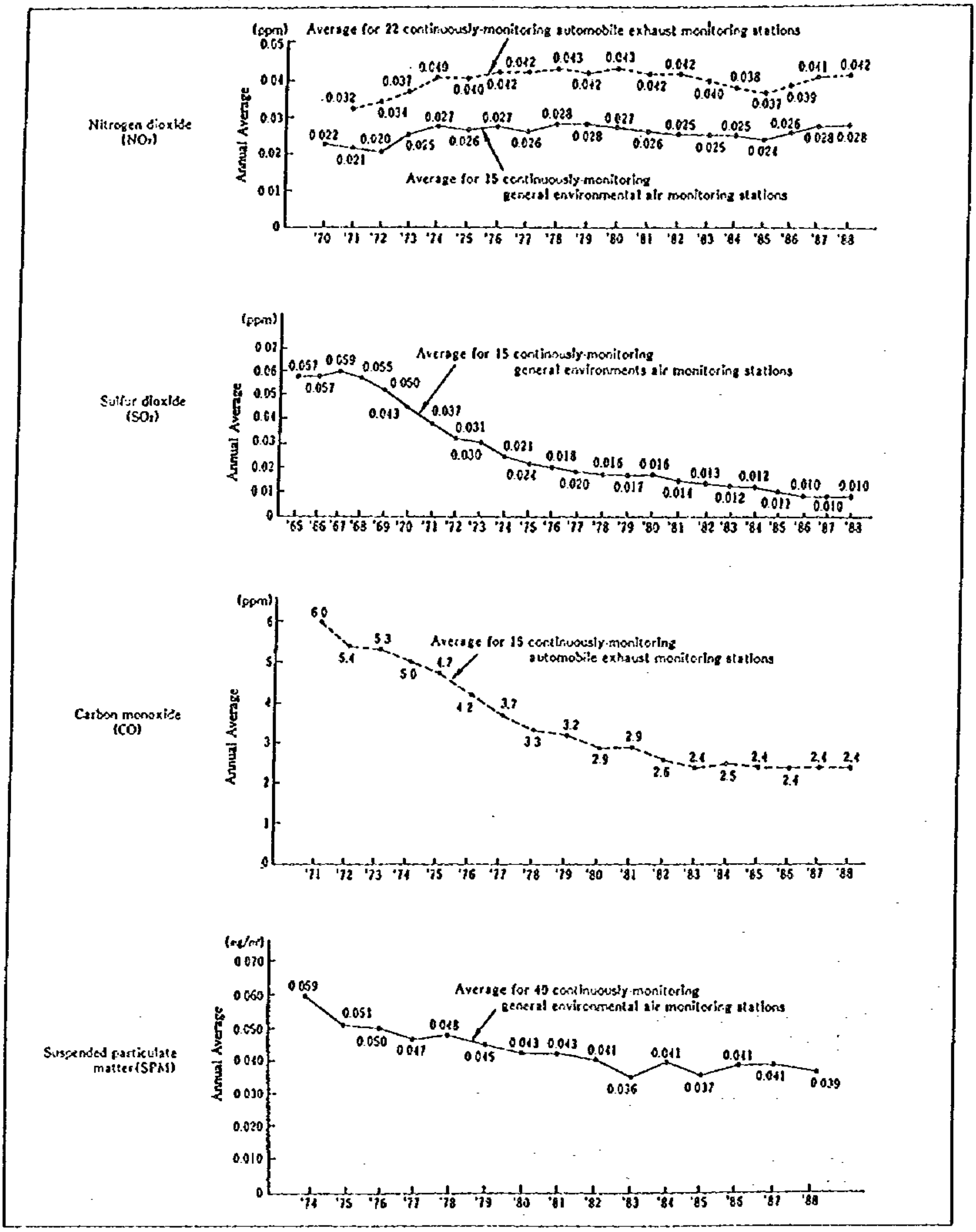


Figure 2: Water Quality in Public Waters and Access to Sewerage by Residences (Yokohama, Osaka, and Kitakyushu) 1955–90

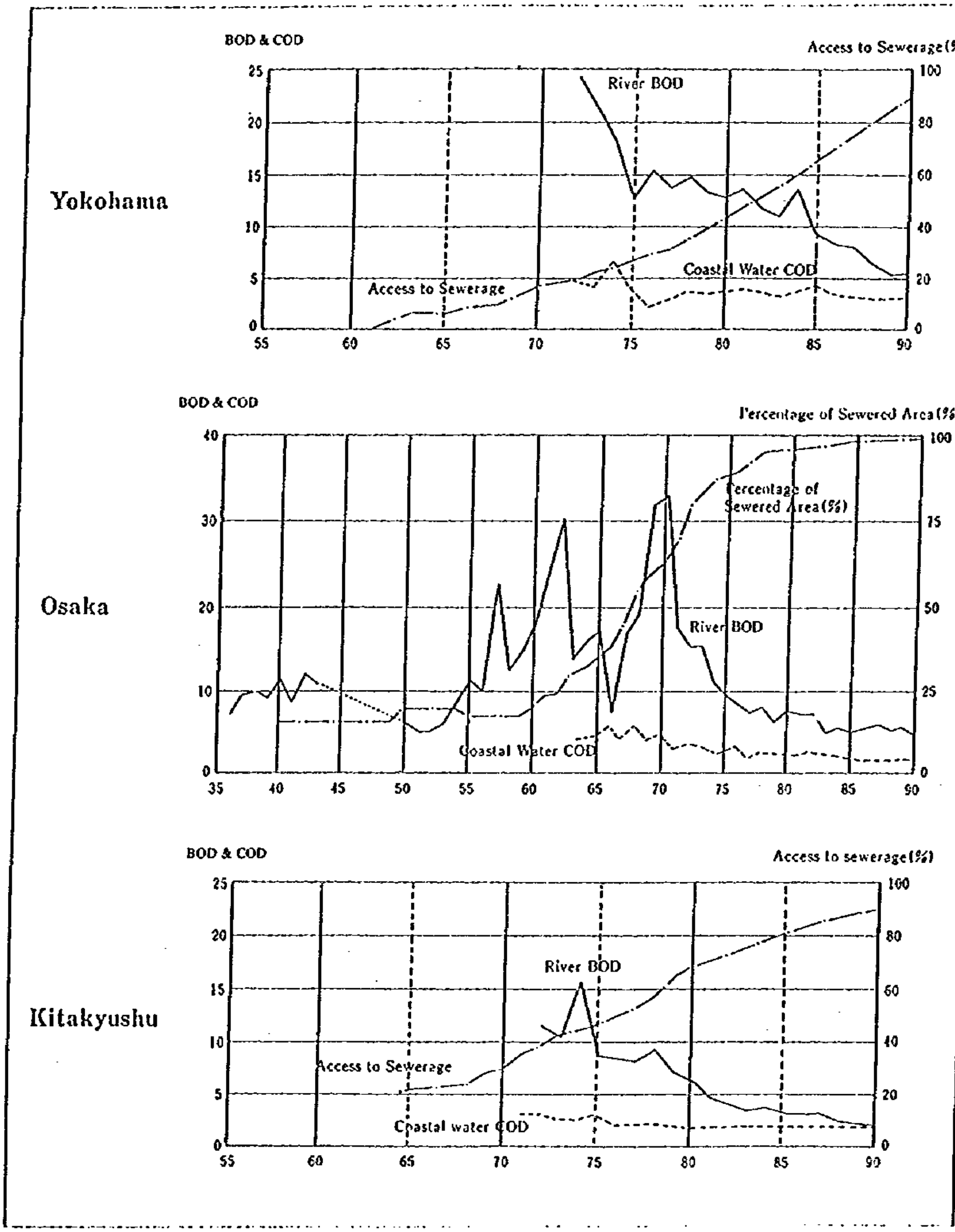


Figure 3: SOx Emission Reduction by Measures (1974 and 1986)

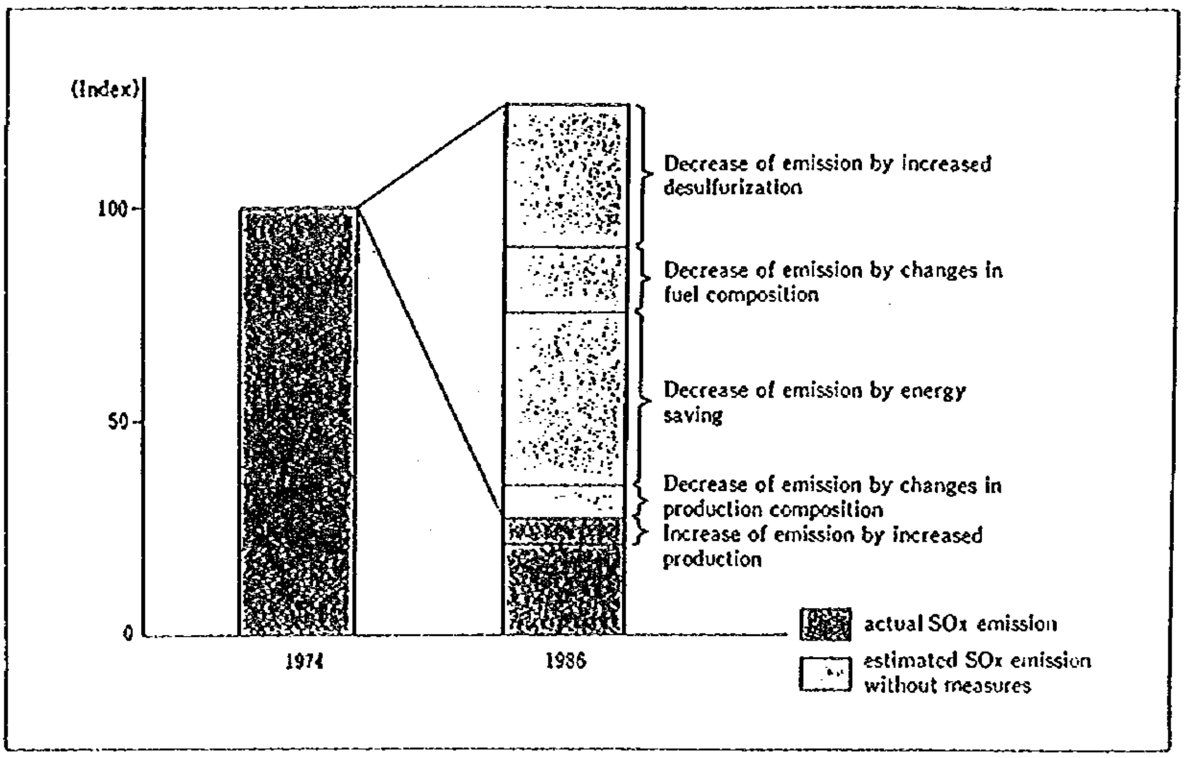
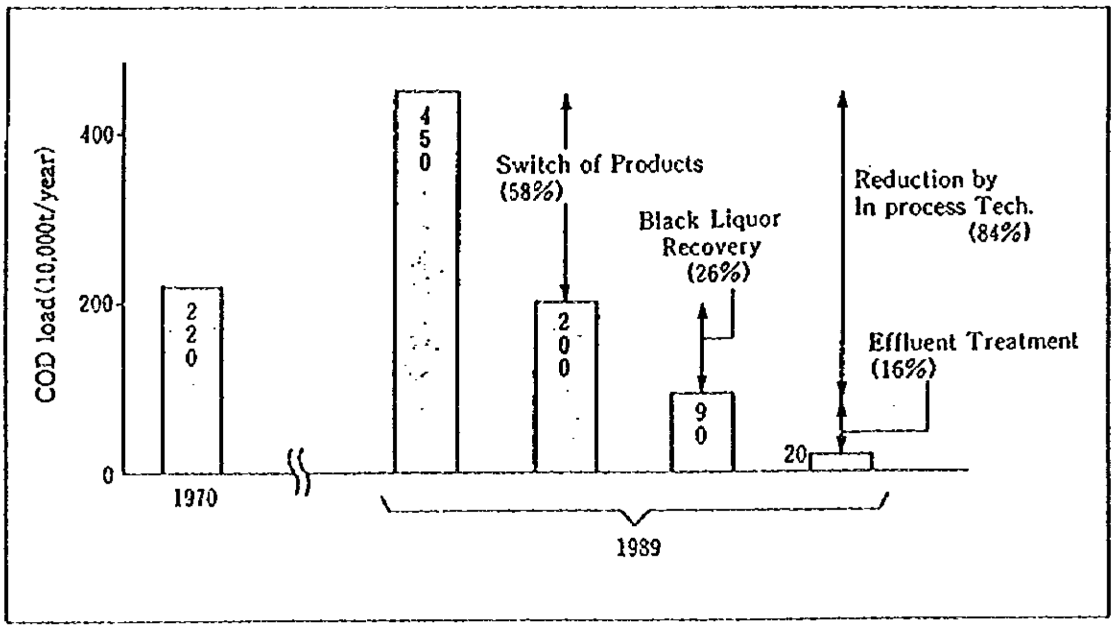


Figure 4: COD Load in Paper and Pulp Industry (1970 and 1989)



Notes:

The largest bar in 1989 shows the estimated COD load with measures. The rightmost bar (the shortest one) in 1989 is the actual COD load with cleaner production technology and end-of-pipe measures. The two bars in the middle show the estimated loads with different cleaner production processes.

categories. First are those organizations established specially for pollution control and environment. The second consists of units which have responsibility for pollution matters, but are located in government ministries and other agencies that have primarily non-environmental objectives. The most important organizations are the Japan Environment Agency in the first group and the Ministry of International Trade and Industry (MITI) in the second.

Japan's rapid progress in carrying out pollution control measures in the 1970s owes much to the conscious efforts of the Ministry of International Trade and Industry (MITI) to build environmental consideration into industrial and energy policy and operations rather than treating them as an "add-on." Although MITI and the Environment Agency often differ over the degree to which environmental measures should be taken, once agreement has been reached, MITI's contribution is generally positive. Since the 1970s it has promoted pollution control technologies and assisted in the development of an environmental sanitation and pollution control industry. Although in the early years of the government's efforts to address environmental problems there was a tendency to react on an ad-hoc, unsystematic basis, which was obviously an inefficient and costly procedure, the current strategy is clearly to adopt a preventive rather than curative approach.

2.2 ORGANIZATION OF POLLUTION CONTROL MEASURES IN BUSINESS ESTABLISHMENTS

Pollution administration in Japan has involved considerable monitoring and guidance on the part of government. In order to implement industrial pollution control measures, pollution control systems in factories and business establishments have evolved in parallel with the administrative developments.

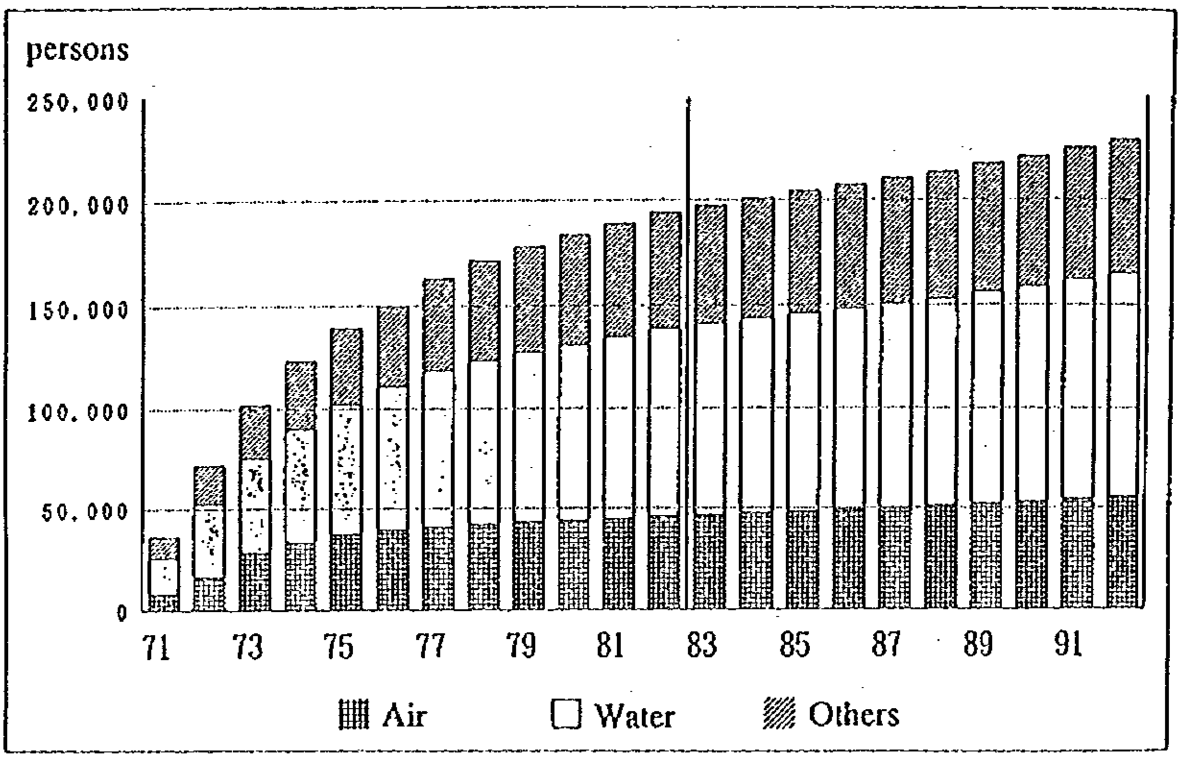
In order to assist this process, in collaboration with industrial groups, the national government has introduced the following procedures:

- a notification system by factories/business establishments for specified facilities;
- monitoring of factory operations;
- preparation of systems for data keeping and reporting;
- responsibility system for pollution control by factories/business establishments based on "Law for Development of Pollution Control Organization for Specified Factories" of 1971; and
- training and assignment of engineers in charge of pollution control.

The 1971 Law stipulates that factories (those with facilities designated by government ordinances as causing soot and smoke, waste water, noise and vibration over certain limits) have primary responsibility for their own pollution control programs. It also sets out the qualifications that responsible personnel within each enterprise should have. These include chief engineers in charge of pollution control, other technical staff, and pollution control managers, who are engineers in charge of management and operation of specified facilities, data analysis and other technical matters.

Pollution control managers must have explicit qualifications. Engineering managers should pass the MITI-controlled examination of high level technology and legislation related to environment. Certain facilities cannot be installed and operated without pollution control managers. The increase in the number of qualified pollution control managers between 1971 and 1991 according to specialty (water pollution, air pollution and other) are shown in Fig.5. These managers have personal responsibility, which may be subject to legal penalty in case of default, for their specified environmental duties. Accordingly they have strong motivation to comply with discharge standards set by relevant laws or voluntary agreements (mentioned later). They are also motivated to perform in such a manner that the benefit will be maximized and cost will be minimized for their factories because they are themselves factory staff. They usually achieve this goal through close cooperation with process engineers. This situation facilitates the development and deployment of CP technologies in industry.

Figure 5: Qualified Pollution Control Engineers 1971-91

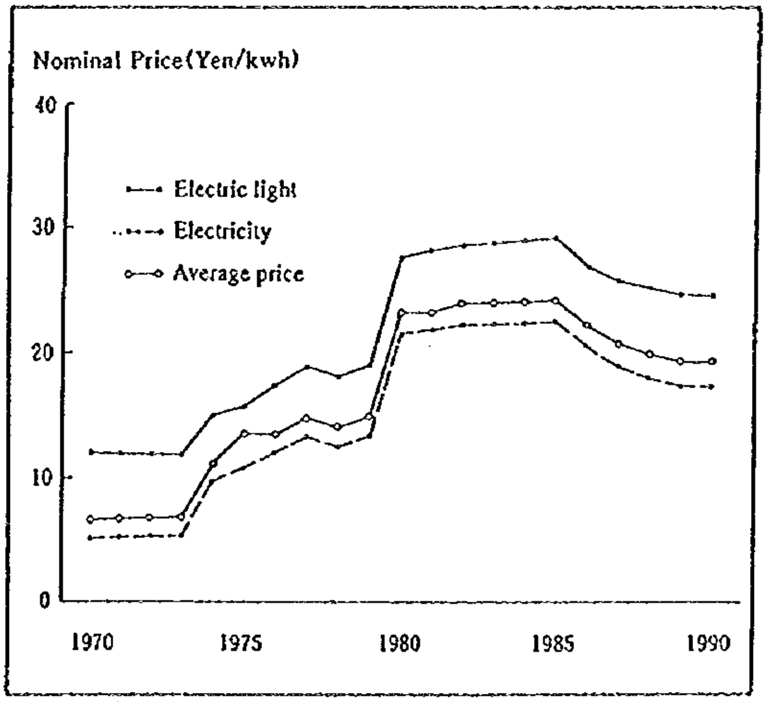


2.3 ENERGY POLICY

Energy policy has contributed to industrial pollution improvement in a number of ways, especially air pollution (directly) and water pollution (indirectly). The switch from coal to heavy oil in the 1950s; the subsequent use of low-sulfur heavy oil, and then the change from heavy oil to LNG and atomic energy have represented various phases in Japan's energy policy. Stimulated initially by the oil crisis in the 1970s, a strict energy conservation policy has developed. Assisted by technical and financial assistance from government, and more rational pricing policies, industry has been encouraged to integrate energy efficiency and conservation measures throughout their production processes. Air and water pollution loads have declined sharply as a result.

In the 1950s and 1960s, charges for industrial water and electricity were set at low rates to promote industrial growth, and large consumers were treated particularly favorably. Declining block rates, or promotional rates, in which the larger the consumption, the lower the price at the margin, were common. However, in the 1970s, rapidly increasing costs led to substantial increases in energy prices, and introduction of progressive charging systems. In addition, all of the ten power companies in Japan have introduced peak load pricing for certain classes of consumer. The explanation for the increase in energy prices is quite straightforward. The increase in international oil prices in 1973 in a country almost totally dependent upon imported fuel, had to be reflected in domestic price increases. Since that time, domestic electricity prices have been maintained in real terms: the continued appreciation of the yen (reducing the effective price of imported fuel) is the explanation for this trend. Average charges for electricity supply over the last two decades are shown in Fig.6.

Figure 6: Average Charges for Electricity Supply in Japan 1970-90



The change to a progressive charging system plus the general increase in rates, has now resulted in highly efficient energy use in Japan, and has been a major contributor to the decrease in air pollution and water pollution loads. This is a classic example of a policy which satisfies numerous objectives; fiscal and financial (by raising revenue); economic efficiency (by reducing wasteful use of scarce resources), and, of course, environmental. Energy consumption per unit of GNP for Japan has consistently been far below that for other OECD countries (65% of average consumption for OECD countries in 1989), as shown in Fig.7. This improvement in energy use efficiency in Japan is largely attributable to the energy saving in manufacturing industries. As shown in Fig. 8, Japan has shown major progress over the last two decades in reducing the amount of energy used per unit of output in major manufacturing sectors, such as pulp and paper, steel, cement and petrochemicals.

Figure 7: **Primary Energy Consumption per Unit of GNP in Japan and other OECD Countries (1960-90)**

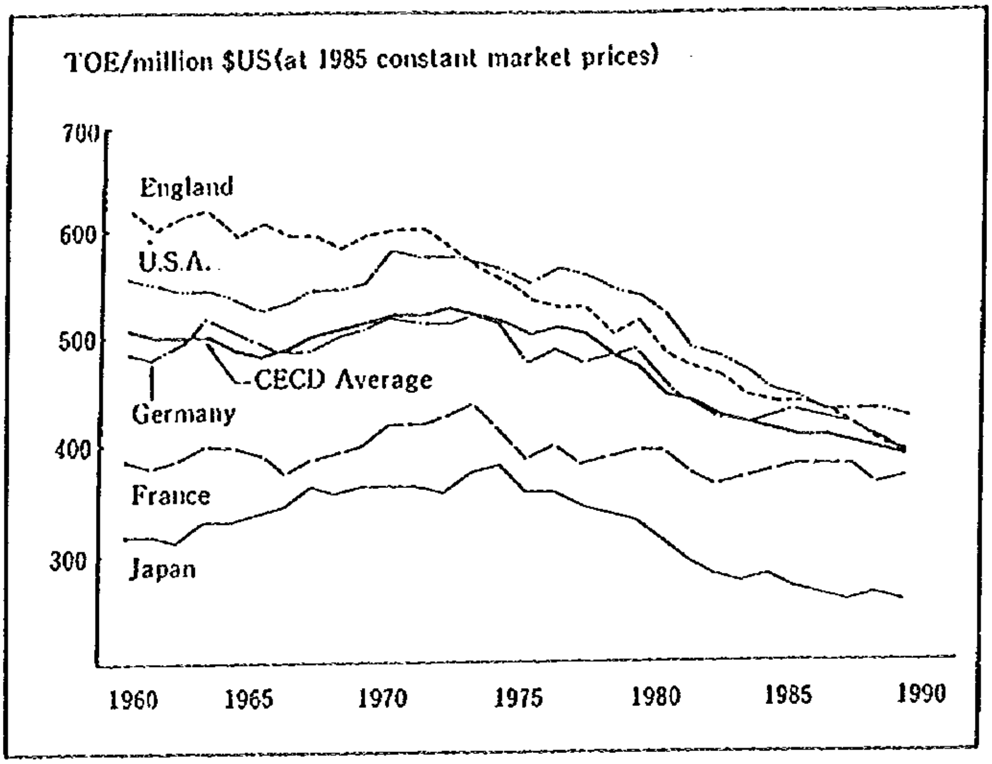
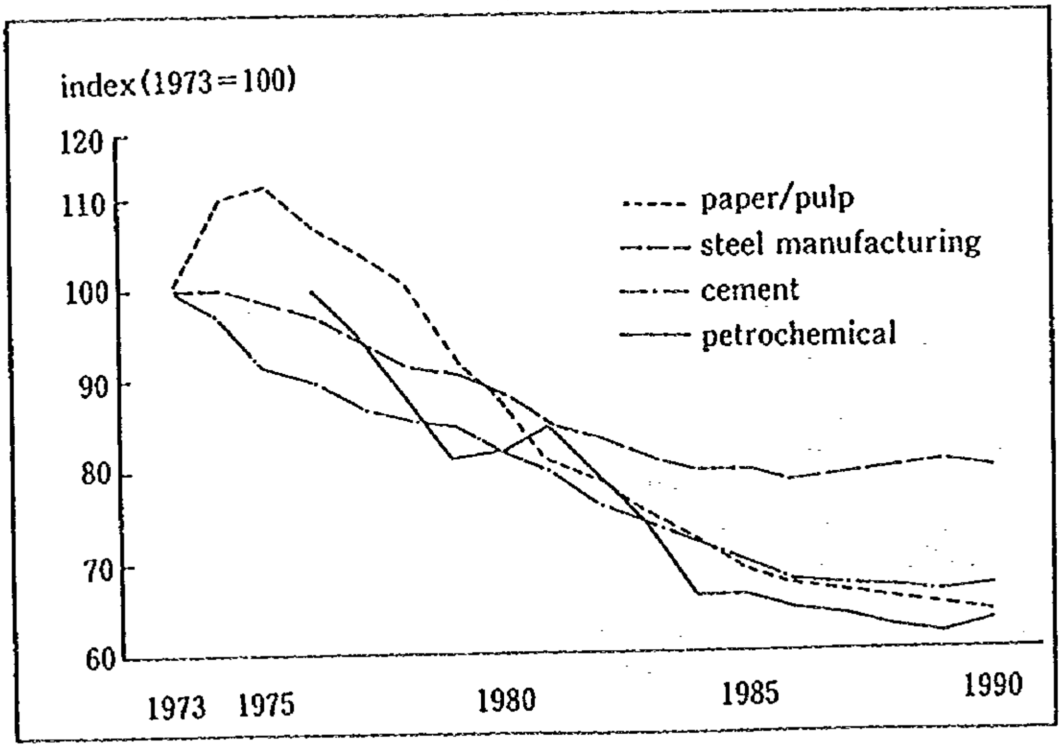


Figure 8: **Energy Consumption per Unit of Production (by Weight): Standard Products of Major Industries (1973-90)**



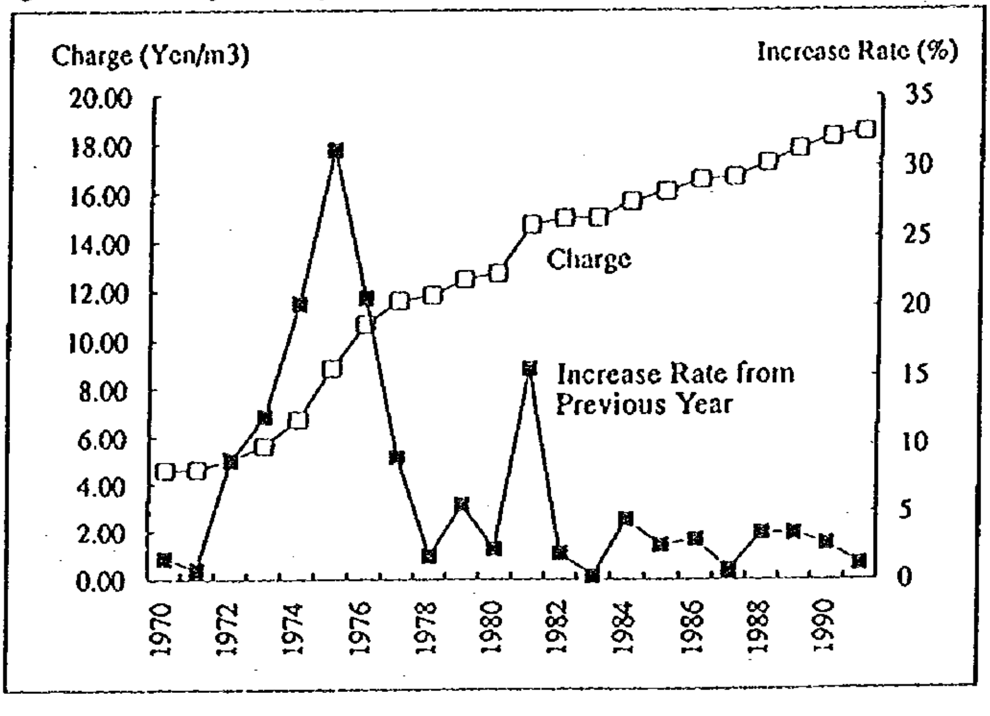
2.4 INDUSTRIAL WATER SUPPLY

There are similarities between energy and water policy in Japan as they impact upon the environment. In both cases, the real costs of consumption have been increasing over time; policies to induce more efficient use for economic or financial reasons have also had beneficial environmental consequences. Those policies have essentially rested upon increasing the costs to consumers, and in particular to the hitherto subsidized industrial users.

Up to 1950, many factories in the coastal areas of the large cities heavily exploited ground water resources, and discharged the effluent into rivers and coastal waters without any treatment. Until this time, apart from pumping costs, the factories incurred no cost for water supply or its disposal. However, pumping up large amounts of ground water caused ground subsidence in coastal areas and the consequent enlargement of the areas in which ground height was under the sea surface, which also resulted in extensive flood damage, particularly during the typhoon season. In light of this, the Industrial Water Law was established in 1956; the regulation of underground water pumping was strengthened, and development of industrial water supply systems as a substitute water source took place.

In developing industrial waterworks, large factories estimated their future water needs and submitted this information to the industrial water undertaking organization (primarily operated by local governments). The factories paid for part of the investment costs as they were incurred, subsequently paying a periodic lump sum for water, based upon the contracted amount, as long as total consumption was actually less than the contracted amount. However, because of the decrease in water demand caused by energy conservation and development of overseas production bases, actual water demand was much less than that estimated. So the factories had surplus water sources at their disposal, and did not make any effort to introduce even low cost water rationalization schemes.

Figure 9: Average Charges for Industrial Water Supply in Japan 1970–91



As economic growth accelerated, placing pressure on existing water resource capacity, and as pollution problems became more serious, the need for greater efficiency in water use was recognized. The water charging system was then changed from the contract water quantity system into one based upon actual consumption. At the same time, large increases in industrial water charges were introduced. Since then, prices have in general been maintained in real terms (see Fig. 9). Combined with expansion of sewerage systems, and the accompanying requirement that firms discharge waste into them (for a fee) rather than discharge waste into rivers, this policy has created the incentive for efficient water use and effluent reduction by companies, resulting in the reduction of the factory effluent load. Further measures were taken in 1975 to restrict new abstraction of ground water, and the areas in which this is permitted have been continually reduced ever since.

2.5 ELECTRICITY AND WATER PRICING

The reaction of the Japanese government to the 1973 oil crisis and at around the same time to the increasing real costs of industrial water supplies prompted a reappraisal of the existing policy of subsidizing industrial enterprises by electricity and water prices that were less than the economic cost of supply. The large increases shown in Fig. 6 and Fig. 9 have been extremely important in inducing firms to be more efficient in their use of energy and water resources, and this has had a beneficial environmental impact. In particular, it has been extremely important in stimulating the user of CP technologies and those which reduce wasteful use of energy and water.

Indeed, it has been estimated that the decline in industrial air and water pollution owes more to energy efficiency improvement, brought about in large part by price reform, than to specific environmental regulations. Thus the introduction of CP processes appear to have been much more significant in reducing pollution loads than EOP measures (see Fig. 3 and Fig. 4).

A similar set of conclusions can be drawn about the industrial water supply pricing reforms of the mid-1970s, which were combined with an expansion of sewerage systems, and the accompanying requirement that where available, industries should connect to them, and pay for the collection, treatment and disposal costs involved. This increase in the cost of water supply and its disposal for industrial users was made still greater by tightening restrictions on groundwater abstraction. The environmental benefits of such a policy can be illustrated with reference to the impact on land subsidence, and by indicators of the extent to which water recycling has increased in recent years.

The environmental impact of the groundwater legislation was considerable. First, Fig. 10 shows that land subsidence, a major problems in many parts of Japan, has effectively ceased in many areas. Since industries were increasingly required to purchase water from municipal suppliers, additional capacity was required by water supply authorities, and costs and prices therefore rose. In effect these changes internalized the external costs hitherto imposed by private abstractors on society, so that water prices began to reflect more accurately social costs. By increasing water supply and disposal costs to industry, the legislation also prompted them to engage in recycling on a much larger scale than hitherto, this being illustrated in Fig. 11.

Figure 10: Land Subsidence in Certain Areas of Japan (1900–90)

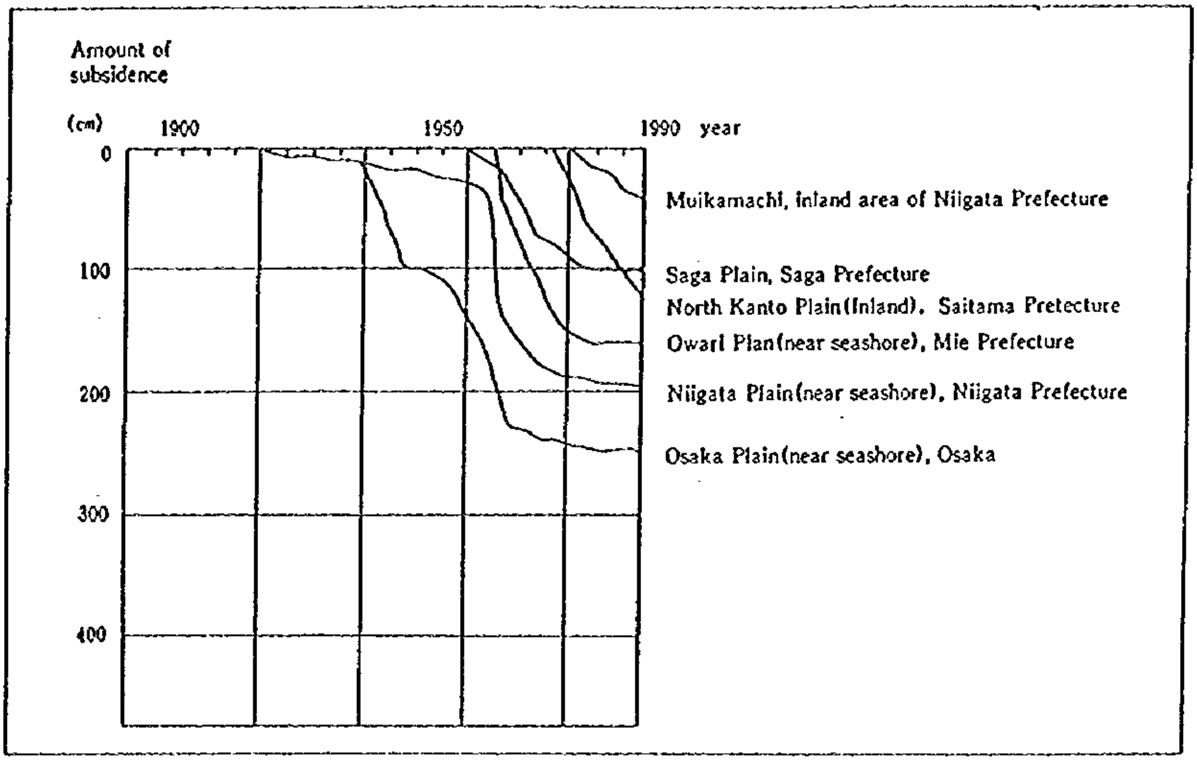
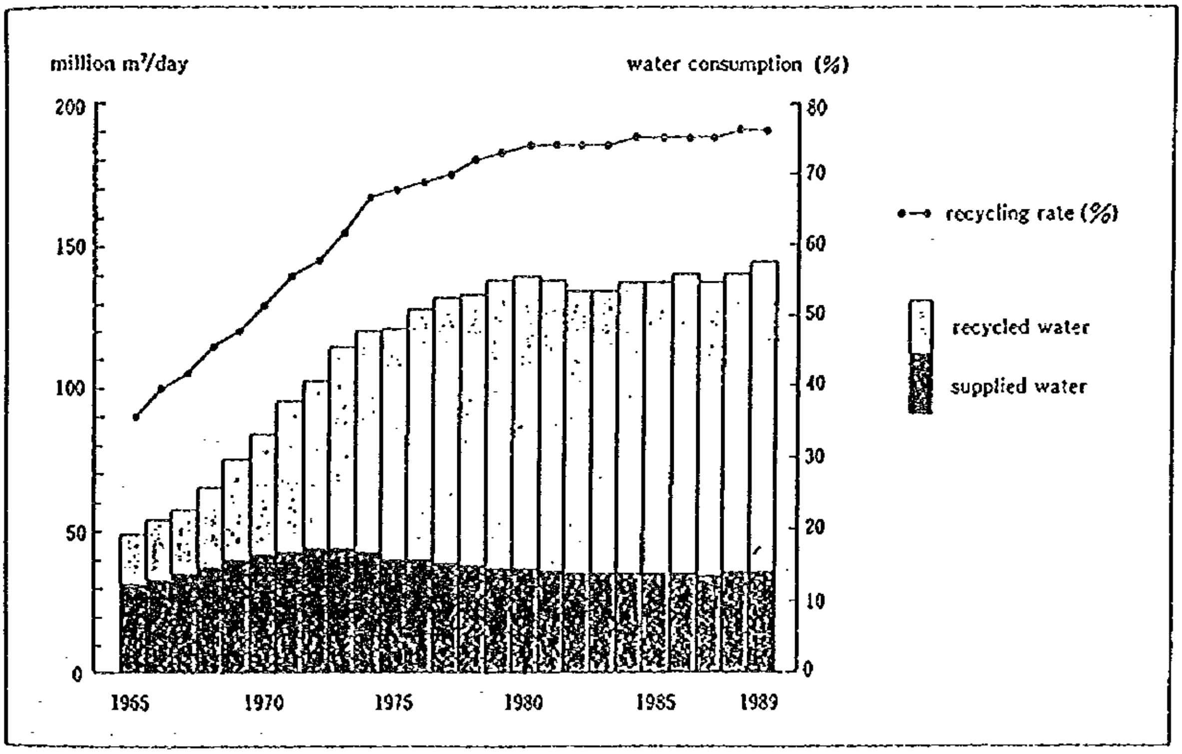


Figure 11: Industrial Water Use and Recycling (1965–90)



Notes:

Recycling rate = Recycled water / Water consumption

2.6 POLLUTION CONTROL AGREEMENTS

A unique characteristic of Japan's approach to environmental problems is the presence of voluntary agreements between local governments and major industrial enterprises operating, or proposing to operate or expand facilities in their area. The local government negotiates with individual plants to arrive at a detailed written agreement on pollution control measures. In these so-called "Environmental Pollution Control Agreements", quantitative emission levels are determined, based on discussion between local governments and enterprises. Local resident groups may be involved in the agreements. These levels, which are more stringent than discharge standards set by the national government, are not regulatory but depend on voluntary compliance by the enterprises. In Japanese society almost all enterprises comply with the agreed emission levels because industry is more afraid of public denunciation and a consequent fall in public esteem than of penal regulations.

In fact, it is indispensable for industrial enterprises to obtain approval and cooperation of local governments and the residents if their operations are to run smoothly. The Environmental Pollution Control Agreement is generally recognized as a critical element in this process. The first major agreement was made between Yokohama City and a thermal power plant in 1964. Since then about 2,500 cases of agreement have been concluded annually; and the number of valid agreements as of September 1991 amounted to about 37,000.

These agreements are renewed periodically and at the time of plant renovation. Accordingly, they work as incentives for the development and use of new industrial processes that integrate productivity improvement and pollution prevention.

2.7 JAPAN ENVIRONMENT CORPORATION (JEC)

The JEC, which was known until 1992 as the Environmental Pollution Control Service Corporation, was established in 1965, financed entirely by the government, in order to evaluate investments and provide financial support for pollution prevention and control measures. The JEC's work consists essentially of site construction and financing. Site construction and transfer includes building of facilities for collective use and provision of industrial sites to which factories can be transferred. Factories transferred apply primarily to SMEs which have, over the years, gradually expanded in sites adjacent to residential areas, causing air and water pollution, ground subsidence, solid waste, noise, vibration, and smells that pose threats to human health and public welfare. This intermingling of industry, commerce, and housing became increasingly serious during the 1960s, and it became clear that separate industrial estates, at some distance from residential areas, were required. Economies of scale in site acquisition and infrastructure development have made assistance from the public sector indispensable, and the JEC now performs this role.

When collective methods cannot be used, the JEC provides soft loans for pollution control measures within factories. Total loans committed by the JEC in fiscal 1990 totaled US$700million. So far more than 6,000 factories have been given soft loans by the JEC. The JEC's soft loans have been provided almost exclusively for EOP facilities because other financing schemes such as the ones by the Japan Development Bank and the Small and Medium Enterprise Finance Corporation have been available for process modification and modernization. The existence of various soft loan schemes for pollution prevention and control has worked as a "carrot" for the development and deployment of CP measures in Japan. Recently, the OECF (Overseas Economic Cooperation Fund of Japan) has introduced, as a program of Japanese official development assistance in environment, similar financing schemes for SMEs in Indonesia and Thailand in cooperation with development banks in respective countries. In these schemes, OECF's soft loans are given to SMEs in two countries through local development banks using so-called two-step loan program. Although these schemes have been developed based on JEC's experiences, loans are available for both EOP and CP facilities.

3. INVESTMENT IN POLLUTION CONTROL

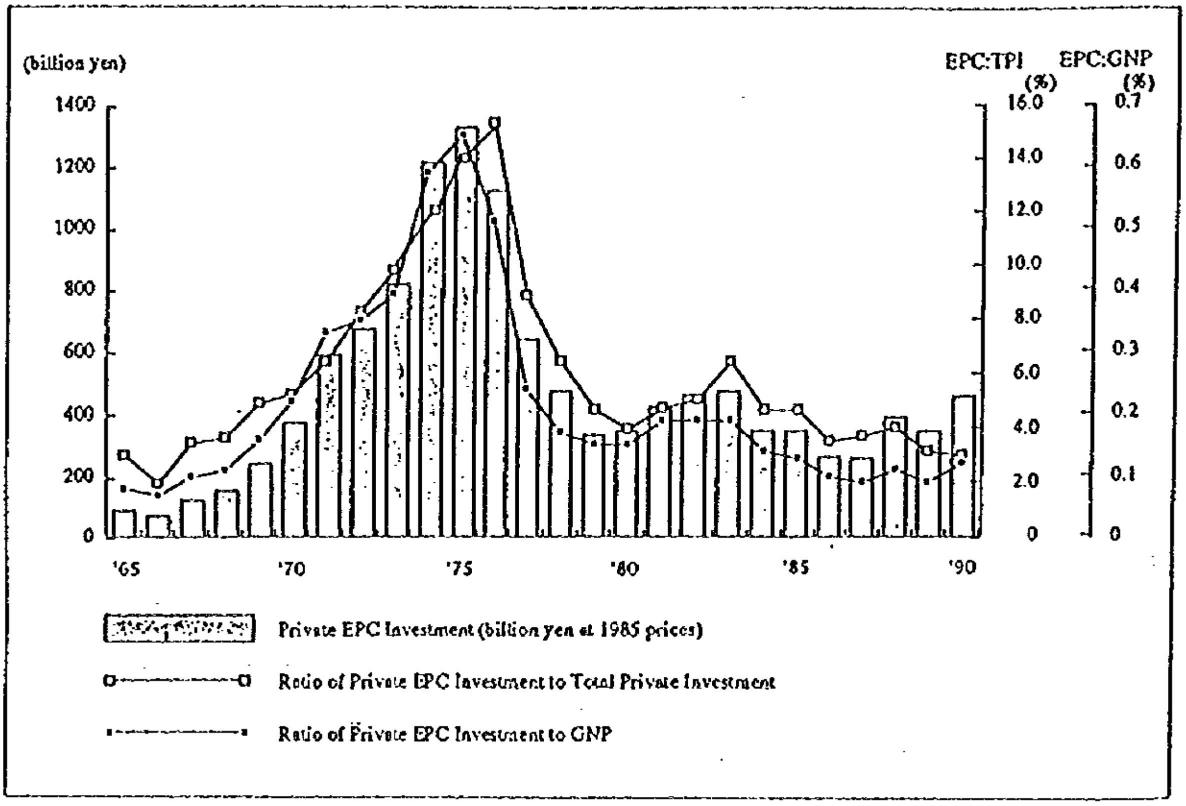
Japan's industrial development and environmental protection policy up until the late 1960s can be summarized as "pollute first and clean up later". This policy was adopted because of the necessity of catching up industrialized countries and of the lack of knowledge about industrial pollution. Years of disregard for the environmental consequences of certain industrial operations in Japan culminated in a series of public health disasters which did much to stimulate people and governments to take serious action against pollution. Cooperation on the part of industry was also assisted by the results of four landmark cases (Kumamoto Minamata Disease, Niigata Minamata Disease, Itai-Itai Disease, and Yokkaichi Asthma) in which victims of industrial pollution sued the industrial enterprises concerned for the damages suffered. The courts found in favor of the plaintiffs in all four cases, the trials all being concluded during the first half of the 1970s.

Prior to the 1970s, virtually total responsibility for pollution control, if it existed at all, had been with local governments. All major governmental initiatives were taken at the local level, primarily in the large cities. Around 1970, the Japanese government began to assume a more substantial role with regard to environmental problems. For example, the Japan Environment Agency was established on July 1, 1971. This was largely in response to the growing awareness of the Japanese people about environment, and increasing knowledge of the risks to health brought about by environmental degradation, particularly pollution. Wide publicity given by the media to the major environmental disasters referred to above were of extreme importance in stimulating government action at the national level.

Environmental degradation, in particular that caused by the discharge of industrial wastes, had therefore become a major political issue by the middle to late 1960s. In 1970, a special Diet session focusing only on environmental pollution issues was held. It was the so called "Environmental Pollution Diet." During this session, 14 bills were established into laws, a number of measures which were to have a major impact upon industrial operations were enacted.

In response to the above-mentioned increasing social and political pressure against industrial pollution, industries increased their investment in pollution control. Fig.12 shows the investment in pollution control in all industry over the period 1965-1990. It will be seen that investments started to become significant in the late 1960s, peaking sharply in the mid-1970s. At their peak, in 1975, investment in pollution control was about 1,300 billion yen, or about 14% of total private investment and 0.63% of GNP in that year.

Figure 12: Investment in Pollution Control: All Industry 1965-90



It is very important to note that investment in pollution control in Fig. 12 is basically for EOP facilities. No specific information about CP investment is available because CP investment is inseparable from process renovation investment. Therefore, a reasonable interpretation of this figure may be that although industries depended at first on EOP facilities to abide by stringent discharge standards, they drastically shifted the approach from EOP to CP after recognizing high cost incurred by EOP approach and experiencing the oil crisis in 1973. This shift was facilitated by rapid renovation of industrial processes in 1970s. They were changed every five years on average while it takes nine years nowadays. Industries, especially large scale ones, took opportunity of making pollution control/prevention investment coincide with reorganization of productive processes necessitated by energy price increases. In the case of SMEs, they have often invested in pollution control/prevention when they have relocated. Indeed, government policy of relocating SMEs has often been dominated by environmental concerns; relocation itself combined with process changes and modernization have been powerful means of bringing about environmental improvements. Investment in pollution control was facilitated by the lending operations of a number of public agencies, all of which loaned funds at subsidized interest rates. These agencies, the Japan Development Bank, the Japan Environment Corporation (JEC), the Small and Medium Enterprise Finance Corporation, and the National Finance Corporation, made available about one third of the investment funds required for pollution control in the 1975 peak year as shown in Table 1. The remaining two third was from industry's own resources, including commercial bank borrowing.

Table 1: Government Lending for Pollution Control Investments (1975)

LEADING INSTITUTION	INTEREST RATE	REPAYMENT PERIOD	MAXIMUM LOAN AMOUNT	LOAN AMOUNT (Billion Yen)
1. Japan Development Bank	8.0%	10 years	50% of Investment	72.3
2. Japan Environment Corp. (JEC)	6.85%	10 years	80% of Investment	26.5
3. Small & Medium Enterprise Finance Corporation	7.0%	10 years	15 billion per loan	18.0
4. National Finance Corporation	7.0%	10 years	1.8 billion per loan	1.7
5. Total (1+2+3+4)				318.5(34%)
6. Commercial Banks	9.1%			
7 Gross Private Investments in EPC				928.6 (100%)

4. CONCLUSIONS

Japanese experience shows that the most important factor for the promotion of CP is the stringent enforcement of environmental regulations. Forced by stringent laws and regulations, Japanese enterprises including SMEs have tries to achieve the required environmental goals in a cost-effective manner, which in many cases has meant the development and use of CP measures. Without stringent law enforcement, few industries would feel the necessity to undertake CP measures. Although law enforcement has been stringent, Japanese environmental policies have been flexible enough to leave the selection between EOP treatment technologies and CP to the discretion of industries as long as the pollution load discharged by each enterprise is within the pre-established limit. This approach has been instrumental in the promotion of CP in Japan.

Japanese experience also shows that incorporation of cleaner processes into production can be easily achieved at the time new plants are set up or during plant/process renovation. This implies that in economies undergoing rapid transition involving the accelerated setting up of new plants and plant/process renovation, technological decision making prompting CP are relatively easy and inexpensive to adopt.

Difficulties frequently encountered in the use of CP in SMEs are the lack of expertise and financial resources. In Japan, these difficulties have been overcome to some extent by the existence of specialized supporting industries and financial schemes for SMEs. The possibility of space economization has also contributed greatly to the use of CP because Japanese SMEs usually suffer from severe shortage of space.

It should be borne in mind that some elements of Japanese experience are not relevant to other countries, while other elements have high potential to be exploited as possible measures for the promotion of CP. Given the economic and cultural diversity of the Asian region, there is certainly no single formula that can be applied to the development and use of CP in Asian countries. It should be noted, however, that this diversity provides challenges as well as opportunities for establishing cooperative efforts in the development and use of CP in this region. Making the most of this diversity, cooperative mechanisms among Asian countries should be explored in order to promote CP technology transfer among Asian countries.

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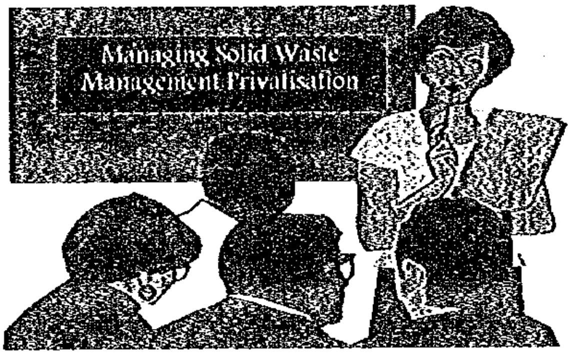
MANAGING SOLID WASTE MANAGEMENT PRIVATISATION

(ENVIRONMENT MANAGEMENT IN URBAN AREA - JAPANESE EXPERIENCE IN OSAKA CITY)

7 AUGUST 1997, BALLROOM 1 LEVEL 2 HOTEL NIKKO KL

by

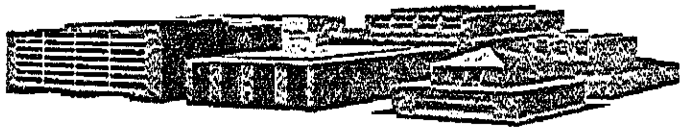


Kamariah Mohd Noor
Senior Manager Operations Planning

Alam Flora Sdn Bhd
Level 5 Wisma HICOM
No 2 Jalan U1/8 Off Persiaran Kerjaya
40150 Shah Alam Selangor Darul Ehsan

Tel : 03 2027922 (general line)
03 2028063 (direct line)
Fax : 03 2028144

ALAM FLORA SDN BHD

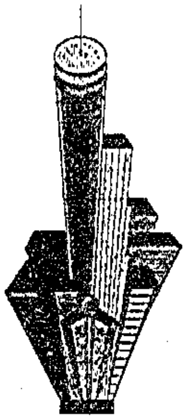


WILAYAH SERVICE AREA

Operations Brief - 15/3/97

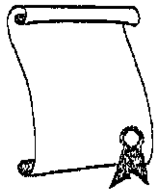
Agenda

- Vision
- Mission
- Wilayah Service Profile
- Wilayah Service Area Function
- Issues
- The Approach
- Proposal



1.0 Vision

•as The Cleanest City in the World



2.0 Mission Statement

•Efficient solid waste and cleaning management service.

•To achieve community support in cleaning the environment.

• To be "Customer-Focused".

•To ensure the waste servicing facilities are operating in a safe, clean and productive environment.

ALAM FLORA SDN BHD

4.0 WSA Function

Operations based on set policies, procedures and guidelines.

Initiate, Plan and Optimise function in all implementation.

Benchmark, Measure and Develop Performance indicators.

Same set to be used for 42 LA over 3 years.

Performance conform to International Standards.

5.0 Issues

Development programme:-

Know the organisation

Occupational skills

Professional skills

Personal skills

Work shift:

• Narrow	JOB	• Multi Direction
• Hierarchical	STUCTURE	• Team
• Department	MEASUREMENT	• Process
• Activities	MANAGMENT	• Results Oriented
• Boss	FOCUS	• Coach
• Protective	VALUES	• Productive

6.0 The Approach

• **1997 Strategic Activities**

•Accountibility in Productivity & Managing Supervisors.

•Develop Policies, Procedures & Systems.

•Private Contractor Development.

•Staff Training.

Dev. Effective, Maintenable Service and Monitoring

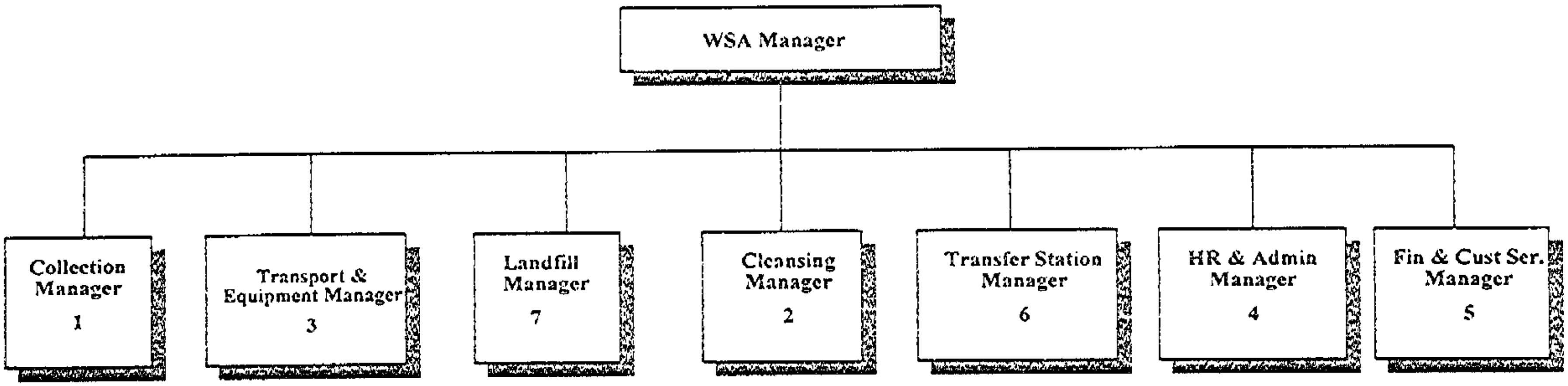
•Recycling

•Landfill

•Good Information System Management

•SW Masterplan for WSA

WSA Organisation Chart



In Conclusion...

•Features	•Advantages	•Benefits
•User friend operationService Delivery Improved. •Comprehensive reports •Generates reports •Work flow supported work process automated	•Operations at ease Good Customer relations. •Control Monitoring of Performance. •Complete information management. •Integrated work public and environment.	•Reducemanual work. •Better Monitoring system HR Performance. •SWMS in placed. •Creates New Opportunities.

Proposed Waste Management System

Equipment (Purchases 1998 - 2017)

Collection Vehicles	4,289
Haul Vehicles	393
Landfill Vehicles	212

Infrastructure

Transfer Stations	27
Recycling Facilities	61
Depots	37
New Landfills	13
Upgraded Landfills	2
New Incinerators	2
Existing Incinerators	2

Service Levels

Domestic
- Kerbside Service
- Bins Supplied
- Residential - 3 times / week
- Shophouses - 6 times / week

ICI
- Commercial service on deman

Existing Waste Management System

Vehicles

- Collection: 565
- Landfills: 81

Facilities

- Landfills: 81

Staff

- Employees: 2,488

Service Levels

- Highly variable

Issues

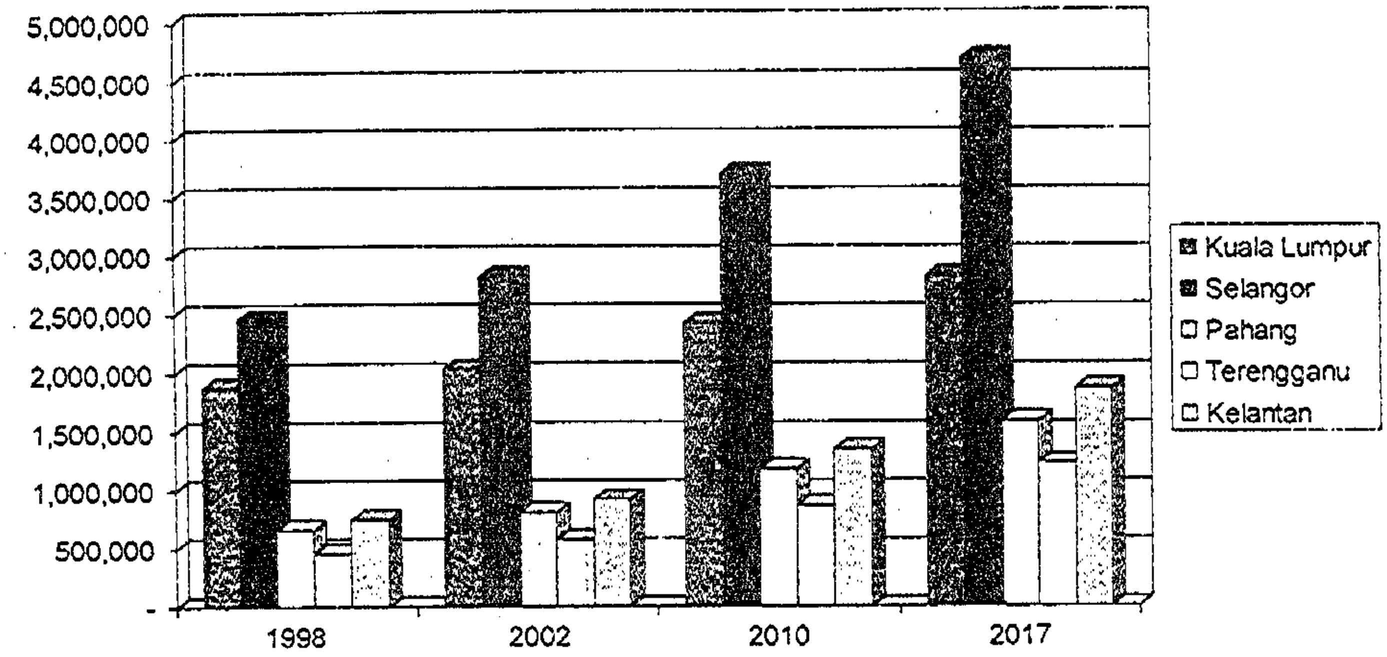
- Collection is somewhat add hoc and highly inefficient
- No modern sanitary disposal facilities
- Widespread illegal dumping
- Public appreciation and practice of responsible waste management is weak

SOLID WASTE MANAGEMENT INFRASTRUCTURE FOR ALAM FLORA

STATE	EXISTING		ADDITIONAL INFRASTRUCTURE					
	LANDFILLS	INCINERATORS	LANDFILLS UPGRADES	NEW LANDFILLS	TRANSFER STATIONS	INCINERATORS	PLASMA	COMPOSTING
KUALA LUMPUR	1	0	0	0	3	0		
SELANGOR	17	0	1	3	6	1		
KELANTAN	17	0	0	1	3	0	1	
PAHANG	31	1	1	4	8	2	1	1
TERENGGANU	17	1	0	1	5	2		
TOTAL	83	2	2	9	25	4	2	1

Population

Concession	6,239,749 →	12,150,852



ESTABLISHING NEW LANDFILLS

- A systematic Site Search
- Enviromentally Secure
- Detailed EIA & DOE Approved
- Enviromental and Operations Management

PROVISION OF TRANSFER STATIONS

- Collection of Waste Generated
- Infrastructure to support the Service Areas and Dispose Sites
- Linkage to Highway Transportation System

DEVELOPMENT OF THERMAL WASTE TREATMENT

- Proven Technology
- Suitable for waste characteristic
- Easily Operated and Managed
- Controlled Emission Level

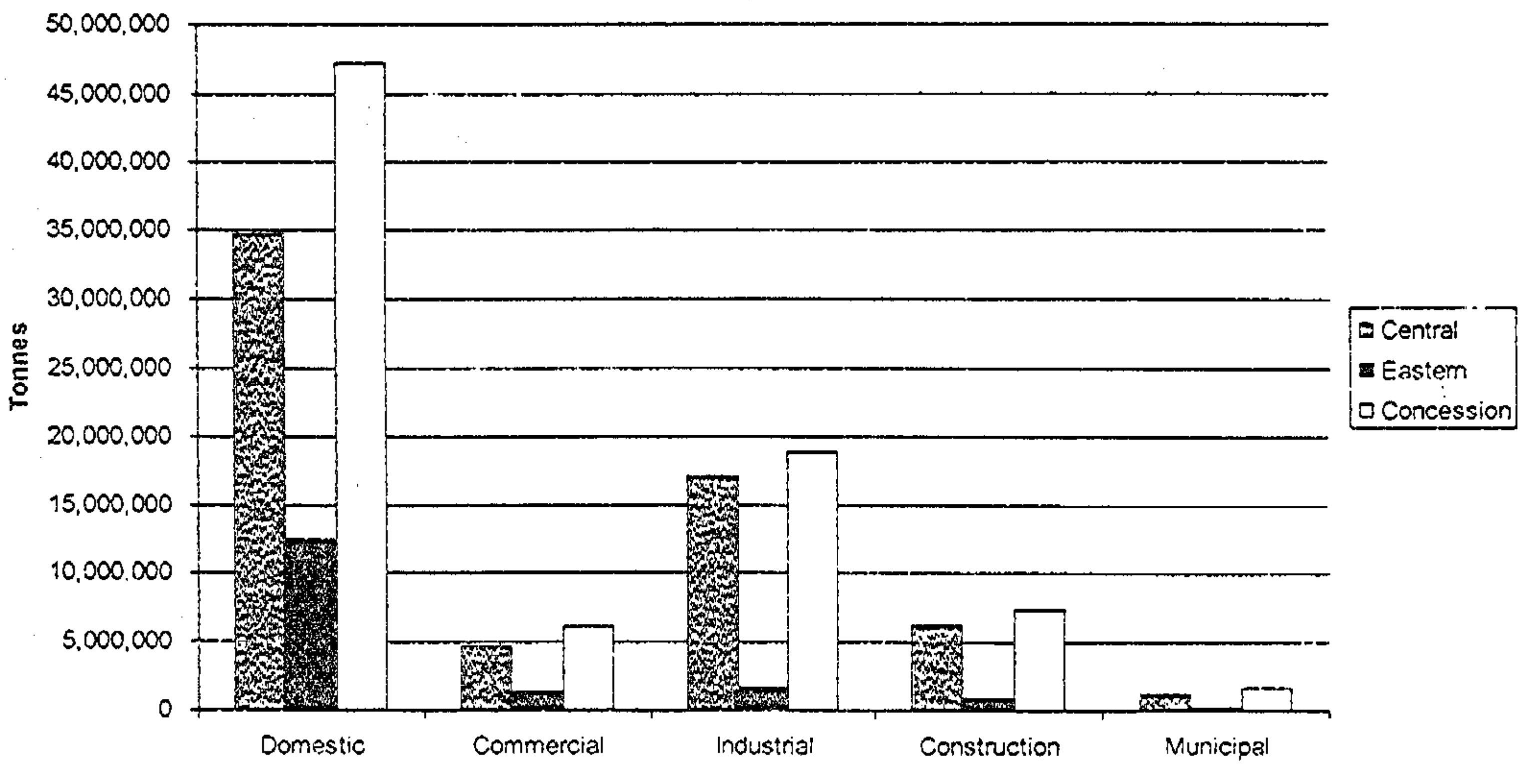
THE PROBLEM

- Too many small short life span dumpsites
- No enviromental controls
- Lack of equipment and site management
- Unapproved sites
- Lack of existing disposal infrastructure

THE SOLUTION

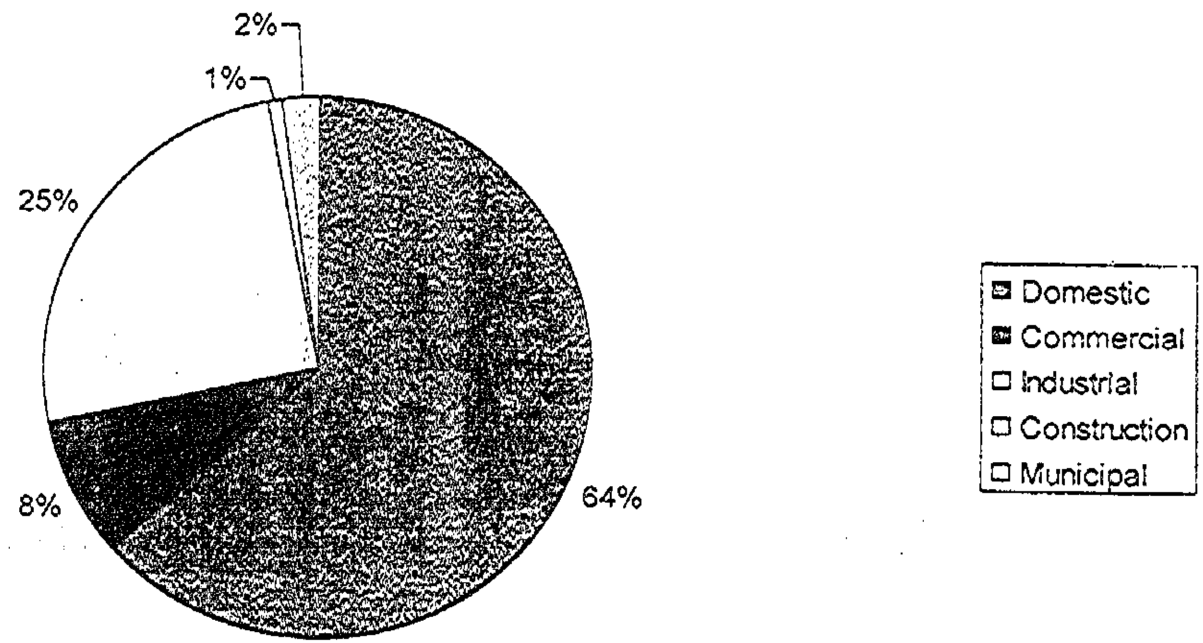
- Interim Landfills
- Upgrade Landfills
- New Regional Landfills
- Transfer Stations
- Thermal Waste Treatment Plant

Waste Distribution by Composition



Waste Composition

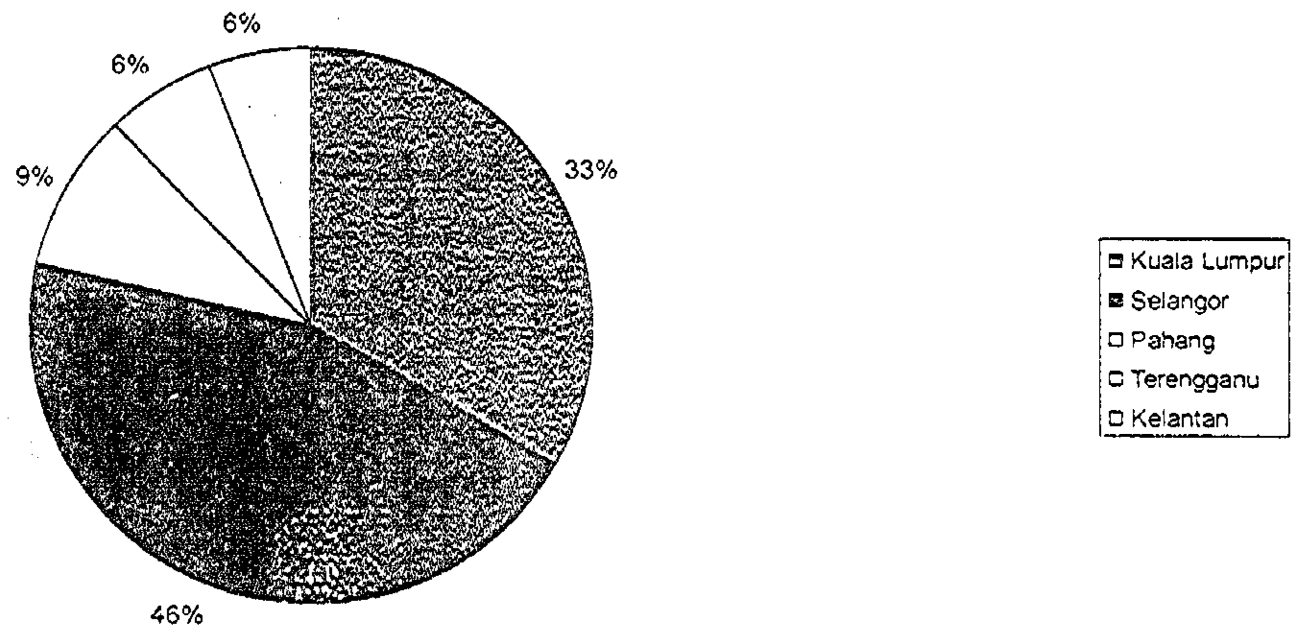
Total Tonnes	79,424,462



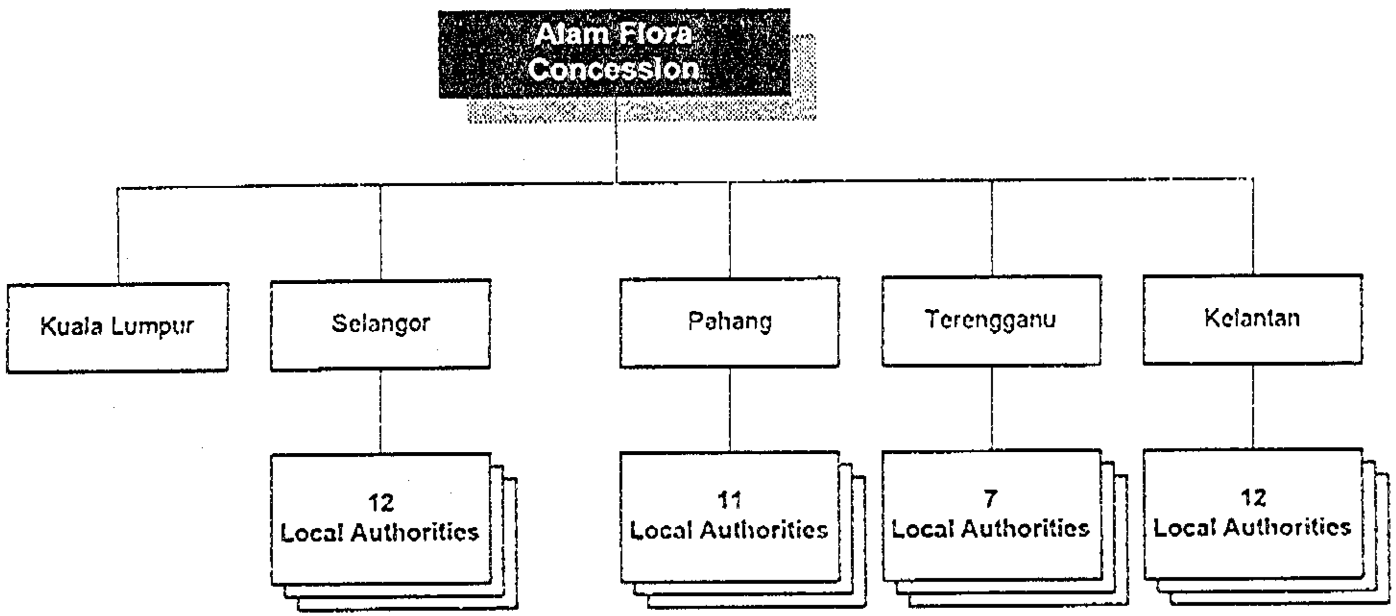
Waste Generation

	1998		2017
Concession	2,889,444	→	5,316,013

Total:
79,424,462 Tonnes



Concession Area



Proposed Waste Management System

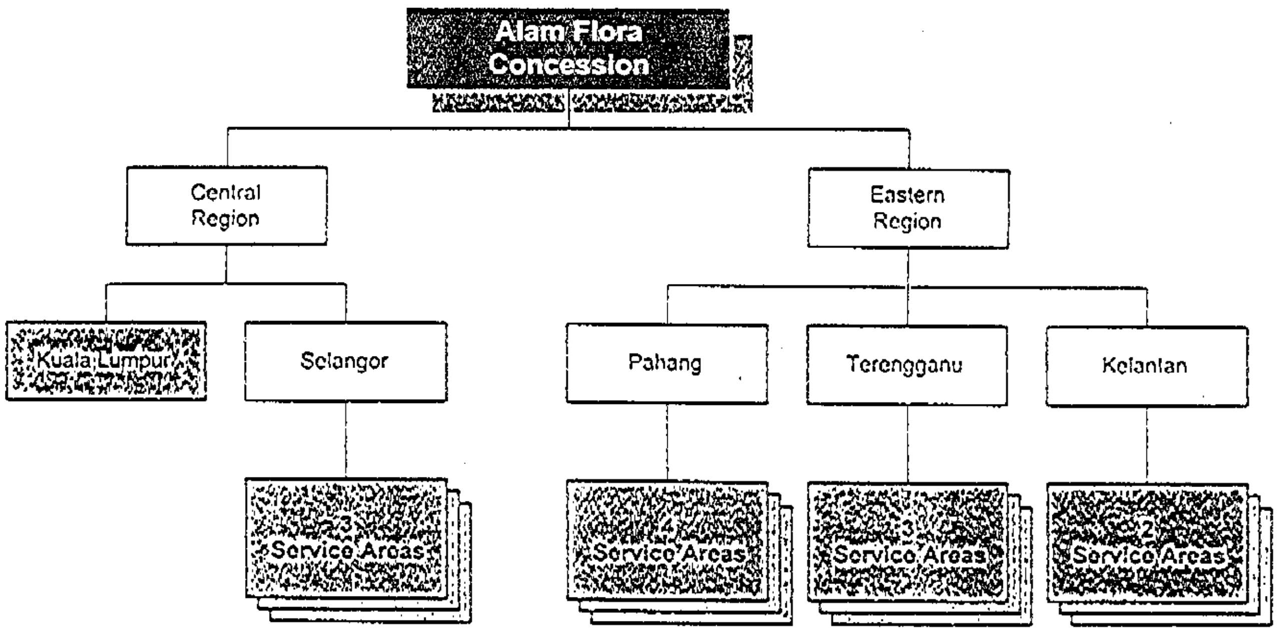
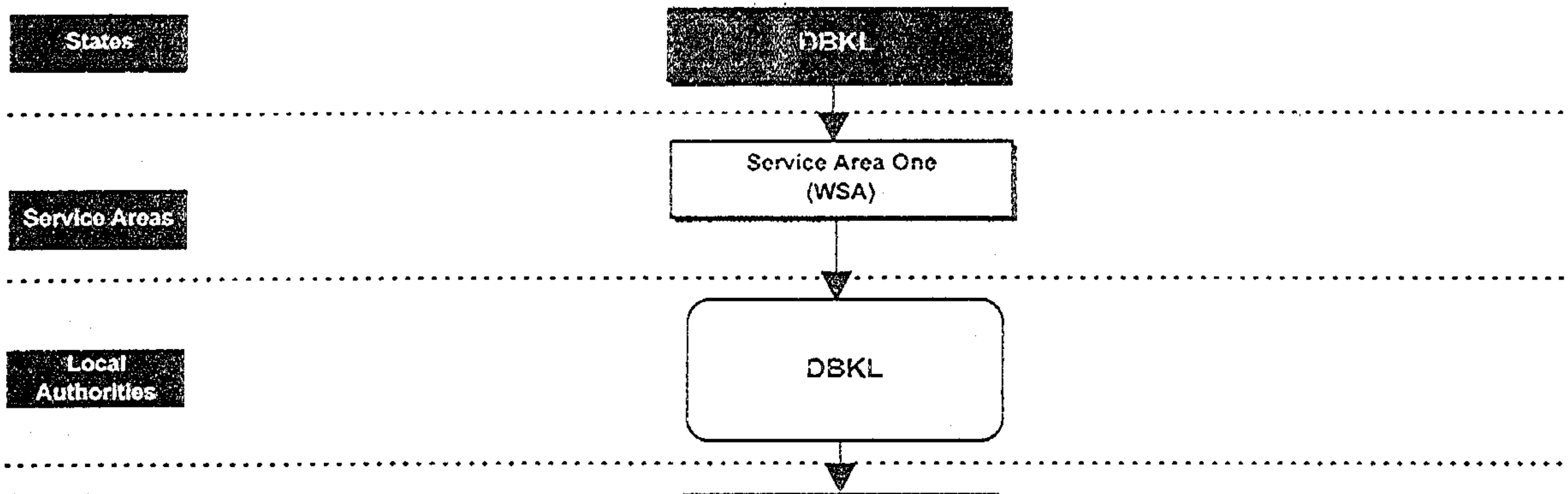


Figure 2: DBKL Service Areas



Market Demand	
Population Served	1.86 million
Waste Disposal (t/y)	1.04 million
Coverage	100%
Facilities	
New Landfills	0
Upgraded Landfills	1
New Incinerator	0
Existing Incinerators	0
Transfer Stations	3
Drop Off Depots	0
Recycling Deports	0
MRFs	1
Baseline Information	
Employees	750
Collection Vehicles	215
Landfill Vehicles	25

4．年度別研修員評価集計

都市排水実績集計

単位：%	平成3年度 1	2	3	4	5	平成4年度 1	2	3	4	5	平成5年度 1	2	3	4	5	平成6年度 1	2	3	4	5
研修範囲	0	100	0			0	100	0			33	67	0			0	100	0		
研修レベル	33	67	0			0	100	0			17	83	0			0	100	0		
専門程度	0	83	17			0	100	0			33	67	0			0	100	0		
配列	67	33	0			100	0	0			33	67	0			86	14	0		
研修目的との関連性	83	17	0			80	20	0			67	33	0			86	14	0		
時間配分	50	50	0			80	20	0			67	33	0			100	0	0		
研修期間	17	67	17			20	80	0			17	83	0			0	86	14		
研修プログラム密度	0	100	0			20	60	20			17	83	0			0	100	0		
期待充足度	17	83	0	0		20	80	0	0		33	50	17	0		29	71	0	0	
習得知識技術の適用性	0	83	17	0	0	20	40	40	0	0	17	67	17	0	0	43	57	0	0	0

	1	2	3	4	5
研修範囲	too broad	about right	too narrow		
研修レベル	too advance(	about right	too elemantry		
専門程度	too deep	about right	not deep enough		
配列	good	fair	poor		
研修目的との関連性	good	fair	poor		
時間配分	good	fair	poor		
研修期間	too long	about right	too short		
研修プログラム密度	leisurely	about right	too hard		
期待充足度	fully met	mostly met	somewhat met	not met	
習得知識技術の適用性	very good	good	fair	poor	very poor

都市排水実績集計

平成７年度					平成８年度					６カ年平均					
1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	単位：%
13	88	0			0	100	0			7.7	93	0			研修範囲
11	78	11			0	67	33			10	83	7.3			研修レベル
0	75	25			0	67	33			5.5	82	13			専門程度
43	57	0			50	33	17			63	34	2.8			配列
43	57	0			33	67	0			65	35	0			研修目的との関連性
57	43	0			33	67	0			65	36	0			時間配分
14	71	14			17	83	0			14	78	7.5			研修期間
0	100	0			17	83	0			9	88	3.3			研修プログラム密度
0	71	29	0		17	67	17	0		19	70	11	0		期待充足度
29	57	14	0	0	17	50	33	0	0	21	59	20	0	0	習得知識技術の適用性

1	2	3	4	5	
toc broad	about right	too narrow			研修範囲
too advance	about right	too elemantry			研修レベル
too deep	about right	not deep enough			専門程度
good	fair	poor			配列
good	fair	poor			研修目的との関連性
good	fair	poor			時間配分
too long	about right	too short			研修期間
leisurely	about right	too hard			研修プログラム密度
fully met	mostly met	somewhat met	not met		期待充足度
very good	good	fair	poor	very poor	習得知識技術の適用性

都市廃棄物実績集計

単位：%	平成４年度 1	2	3	4	5	平成５年度 1	2	3	4	5	平成６年度 1	2	3	4	5	平成７年度 1	2	3	4	5
研修範囲	0	83	17			60	40	0			0	100	0			0	100	0		
研修レベル	0	100	0			0	100	0			0	100	0			0	100	0		
専門程度	0	100	0			0	80	20			0	86	14			0	57	43		
配列	67	33	0			20	80	0			29	57	14			57	43	0		
研修目的との関連性	83	17	0			60	40	0			100	0	0			86	14	0		
時間配分	50	33	0			60	20	20			86	14	0			57	29	0		
研修期間	0	83	17			40	40	20			0	100	0			0	71	29		
研修プログラム密度	0	100	0			0	100	0			14	57	29			0	86	14		
期待充足度	33	67	0	0		20	80	0	0		43	57	0	0		50	33	17	0	
習得知識技術の適用性	17	67	17	0	0	20	80	0	0	0	0	86	14	0	0	43	43	14	0	0

	1	2	3	4	5
研修範囲	too broad	about right	too narrow		
研修レベル	too advanced	about right	too elemantry		
専門程度	too deep	about right	not deep enough		
配列	good	fair	poor		
研修目的との関連性	good	fair	poor		
時間配分	good	fair	poor		
研修期間	too long	about right	too short		
研修プログラム密度	leisurely	about right	too hard		
期待充足度	fully met	mostly met	somewhat met	not met	
習得知識技術の適用性	very good	good	fair	poor	very poor

都市廃棄物実績集計

平成8年度					過去5年間平均					
1	2	3	4	5	1	2	3	4	5	単位：%
0	100	0			12	85	3.4			研修範囲
13	88	0			2.6	98	0			研修レベル
0	100	0			0	85	15			専門程度
38	63	0			42	55	2.8			配列
50	60	0			76	26	0			研修目的との関連性
63	38	0			63	27	4			時間配分
13	50	38			11	69	21			研修期間
0	100	0			2.8	89	8.6			研修プログラム密度
25	75	0	0		34	62	3.4	0		期待充足度
25	25	50	0	0	21	60	19	0	0	習得知識技術の適用性

1	2	3	4	5	
too broad	about right	too narrow			研修範囲
too advance	about right	too elemantry			研修レベル
too deep	about right	not deep enough			専門程度
good	fair	poor			配列
good	fair	poor			研修目的との関連性
good	fair	poor			時間配分
too long	about right	too short			研修期間
leisurely	about right	too hard			研修プログラム密度
fully met	mostly met	somewhat met	not met		期待充足度
very good	good	fair	poor	very poor	習得知識技術の適用性

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