# COUNTRY SANITATION ASSESSMENT IN MALAYSIA

# REPORT


**November 2011**

JSC
Japan Sanitation Consortium
APWF KNOWLEDGEHUB
Solving sanitation issues
in the Asia-Pacific

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## 1. FEATURES OF THE MALAYSIAN SEWERAGE AND SANITATION

The features of Malaysian Sewerage and Sanitation can be summarized as follows.

1) In Malaysia, access to "Improved Sanitation" in 2010 reached 96 percent and sewerage diffusion in urban areas covered about 70% percent of the population, which are significantly high among the developing countries of Asia.
2) From the 1980s, the government introduced a policy that obliges housing developers to build sewerage systems for areas gathering more than 30 households of 150 population equivalent (PE). This resulted in the diffusion of many small-scale wastewater treatment facilities all over the country, which are gradually being connected to large-scale sewerage systems to complete the public sewerage system.
3) Malaysia is one of the few developing countries that obtained a certain success in septage management for sanitation improvement.
4) A same administrative body manages the collection and treatment of sludge from sewerage systems and septic tanks.
5) In addition to this administrative body, a specialized organization called Indah Water Konsortium (IWK) has the responsibility and is entrusted for wastewater management and sludge collection and treatment.
   IWK differs from the Japan Sewage Works Agency in that the latter focuses on the construction of sewerage facilities, while the former concentrates on maintenance.

For information, Table 1 shows general data on Malaysia to understand the economic aspect of this country.

Concerning the nominal GDP per person in Southeast Asia, Malaysia is the third country after Singapore at US$43,000 and Hong Kong at US$32,000. We think that this contributes greatly to sanitation.

Table 1: General data on Malaysia

| | |
|---|---|
| 1. Area | About 330,000 $km^2$ |
| 2. Population | 28,400,000 people (Department of Statistics, 2010) |
| 3. Ethnic groups | Malay (66%), Chinese (about 25%), and Indian (about 8%)<br>Note: The first group includes races other than Chinese and Indian. |
| 4. Languages | Malay (official), Chinese, Tamil, and English |
| 5. Religions | Islam (federal), Buddhism, Confucianism, Hinduism, Christianity, and native faith |
| 6. Key industries | Manufacturing (electric appliances), agriculture and forestry (natural rubber, palm oil, and timber), and mining (tin, crude oil, and LNG) |
| 7. Real GDP | US$173,800,000,000 (2010) |
| 8. Nominal GDP per person | US$8,323 (2010) |
| 9. GDP growth rate | 7.2% (2010) |
| 10. Customer price increase rate | 1.7% (2010) |
| 11. Assistance from Japan (accumulated amount as of FY 2009) | (1) Loan aid: 969,300,000,000 yen (Exchange of Notes)<br>(2) Grant aid: 13,800,000,000 yen (Exchange of Notes)<br>(3) Technical cooperation: 109,600,000,000 (JICA's expenses) |

| | |
|---|---|
| 12. ODA from key countries (net disbursements in 2008 shown by DAC) | Japan: US$113,830,000<br>GB: US$18,920,000<br>Germany: US$10,830,000 |
| 13. Key bilateral treaties and agreements | Economic partnership agreement between Japan and Malaysia (signed in December 2005 and entered into force in July 2006) |

## 2. SEWERAGE SYSTEMS IN MALAYSIA

### (1) Changes in the Malaysian sewerage technology

Figure 1 shows period-by-period changes in sanitation improvement and wastewater treatment in Malaysia, which was presented by IWK at the conference "2nd IWA Development Congress & Exhibition, PIONEERING WATER SOLUTIONS IN URBANISING AREAS" held in Kuala Lumpur on November 21 to 24, 2011[2)].

According to the presentation, from the 1950s to the 1960s Malaysia focused on the primary treatment of wastewater to improve public sanitation, and promoted the use of non-flush toilets with pit latrines, flush toilets with pour flush latrines, and septic tanks.

In the 1970s and later, the government aimed at the secondary treatment of wastewater to purify polluted rivers as the next step of public sanitation. Imhoff tanks were diffused in the 1970s, as well as the stabilization pond method (OP or oxidation pond shown in Figure 1) and the aerated lagoon process (AL indicated in Figure 1) in the1980s, and the activated sludge and biological filtration processes in the 1990s.

Since around 2000, the Malaysian government has focused on environmental preservation to introduce and install wastewater treatment plants that can remove nitrogen and phosphorus.

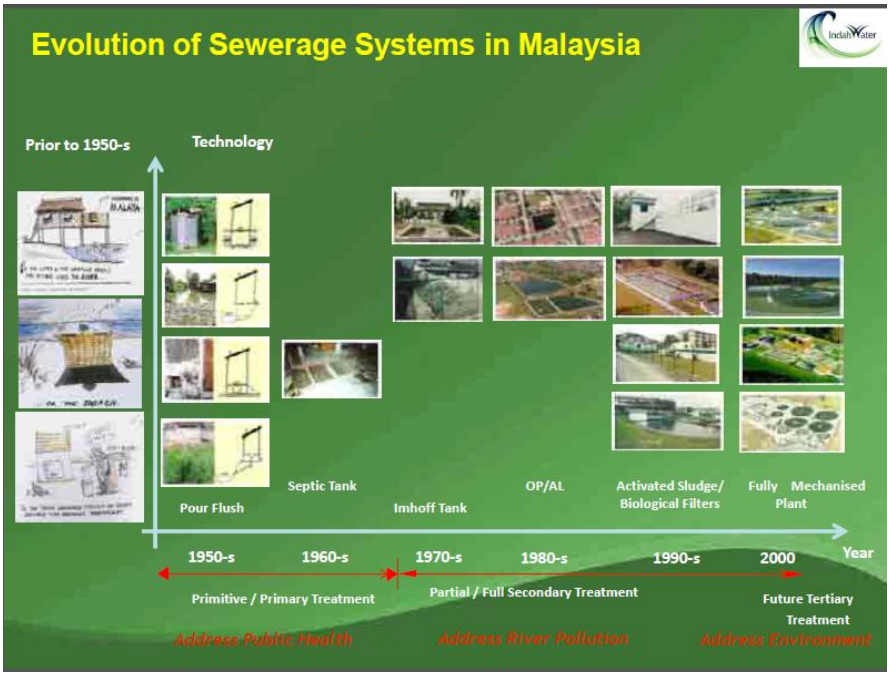


Figure 1: Period-by-period changes in Malaysian sewerage systrems[2)]

**(2) Changes in the Malaysian sewerage administration**

1) Before the 1980s

Before 1957, when Malaysia declared its independence, local sanitation committees were responsible for sanitation in rural areas while local governments managed sanitation in urban areas.

From the end of the 1960s, the Malaysian government launched of a series of five-year plans which had for purpose to construct appropriate sanitation facilities in both urban and rural areas. At that time, septic tanks were the main sanitation systems and, in the 1970s, the government started a "National Sewerage Development Program" to develop sewerage facilities in major cities with the aim to introduce modern sewerage systems in urban areas. This program was integrated into the five-year development plan and resulted in the development of a series of master plans. However, due to the inability of existing financing structures and the difficulty for the government to gather sufficient resources, these master plans were implemented in only Kuala Lumpur, Butterworth, and Kinabalu. As a result, sewerage services and development were fully entrusted to local governments, which faced difficulties as well, such as financial shortage and lack of knowledge to provide modern sanitation infrastructure.

2) After the 1980s

In the 1980s, to slow a rise in population having no basic sanitation, the Malaysian government developed a new policy. This obliged any development projects for 30 households or 150 people equivalent to install a sewerage system. Meanwhile, septic tanks for individuals or communities prevailed in places with a more limited number of houses. This new arrangement has encouraged the private sector to play a key role in developing sewerage systems in Malaysia, building about 70 to 80 percent of the wastewater treatment infrastructure. The arrangement has also enabled the public sector to give priority to infrastructure construction for drinking water and energy, and to delay the investment in large-scale sewerage.

Notwithstanding, a rise in the number of small-scale sewerage systems resulted in an accumulation of a wide range of low-cost technologies for wastewater treatment and disposal systems while leaving unsolved the problem of houses without wastewater treatment facility. In an effort to regulate and standardize sewerage products, the government set up an inter-ministry committee, formed under the Ministry of Housing, in charge of approving new construction systems built by developers.

Until 1994, 144 local governments controlled sewerage services all over the country. However, these services were not consistent and in many areas, standards were not met. The federal government understood the need for improving the sanitation level of the country and passed the Sewerage Service Act (SSA) in 1993. The purpose of the Act was to make Malaysia an advanced nation with modern infrastructure. According to the Act, the federal government became responsible for controlling all sewerage assets and signed a concession agreement with IWK to entrust the management of sewerage services. The contract included operation, maintenance, and development (that is, upgrading, rehabilitation and expansion of sewerage infrastructure) over a 28-year concession period.

More specific purposes were to build infrastructure, to improve the efficiency of investments and services, to reduce the governmental involvement ratio, and to provide a venue for competition from the private sector. The Sewerage Service Department (SSD) was organized under the control of the Ministry of Housing and Local Government (currently under the Ministry of Energy, Green Technology, and Water) to regulate and monitor sewerage services entrusted to IWK. The concession covers the entire country except the states of Johor, Kelantan, Sabah, and Sarawak, which remain under the control of their respective local governments. When management was transferred to IWK, the ratio of connection to

sewerage was 5 percent and large-scale sewerage systems were installed only in large cities having a population of more than 100,000 persons. IWK agreed to increase the sewer connection rate to 85 percent in major cities and to 30 percent in small to medium cities, and to conduct septage management.

IWK planned activities and first conducted a number of sewerage studies in order to assess demand and capacity from a 30-year planning horizon. Next, IWK designed a 3-phase strategy according to the study results. The phases were (1) locating and upgrading the old wastewater treatment plants as well as increasing septage collection capacity, (2) using available oxidation ponds as a temporary measure for septage treatment and constructing trench treatment facilities in accordance with the guidelines provided by the Department of Environment, and (3) building centralized and mechanized treatment facilities in areas with high population density. In addition, IWK developed a database of the houses connected to a septic tank and started scheduled desludging by geographic area.

IWK made several-year efforts to let the residents understand the value of sanitation and raise awareness on the importance of good practices and the acceptance of desludging and sewerage charge payment.

3) Recent years

To improve operation and maintenance, IWK has gradually taken over sewerage systems of various sizes and types. From 1994 to 2008, more than 8,800 systems have become public systems and come under IWK's control while more than 3,000 systems remain under the direct management of the owners and, thus, are classified as private systems. IWK does not own the public facilities but only operates and maintains them, which gives this organization the right to collect sewerage charges. On average, IWK takes over 300 treatment facilities and 1,000 km of sewer network yearly. However, in areas where large-scale sewerage systems are not provided, private developers will continue to construct small-scale sewerage systems.

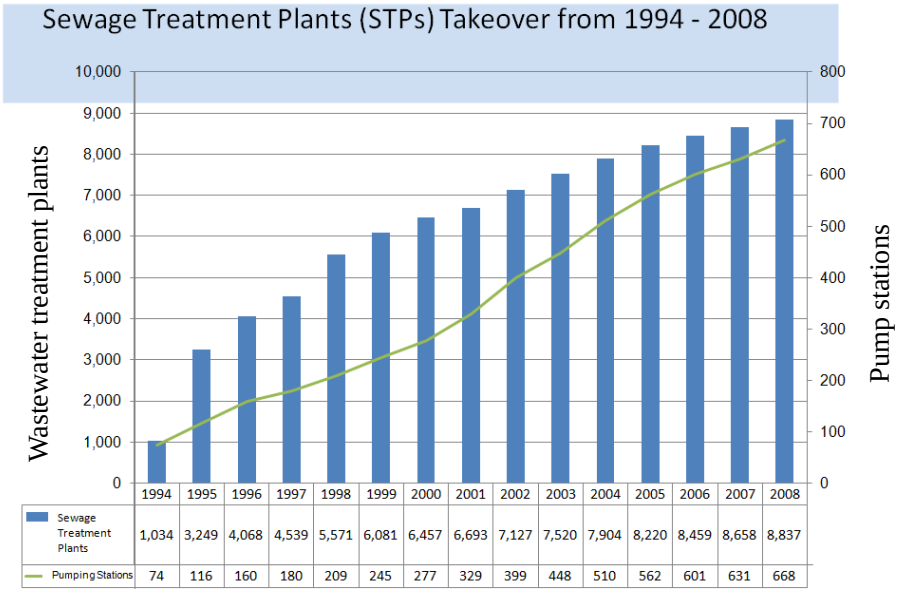


Figure 2: Wastewater treatment plants transferred to IWK from 1994 to 2008

4) Legal system and IWK's operation

IWK's involvement as a contractor introduced a sewerage charging system for individuals and enterprises. The system induced citizen's complaints, resulting in three-time charge reduction.

Furthermore, the sewerage charges could not cover the business expenses and IWK had difficulties to collect the charges which if continued would have led the company to insolvency and would have affected sewerage services. As a result, IWK was placed under governmental control in 2000. Since then, IWK has been managed as a private company while the government, under the Ministry of Finance, has been controlling capital expenditure. SSD took the new responsibility of being an implementing agency managing sewerage constructions, in addition to its previous role as a regulator of the sewerage industry.

In 2006, the Malaysian Parliament passed the Water Service Industry Act (WSIA), which replaced the Sewerage Service Act. The latter provides the regulatory framework of sewerage and septage management, and requires the owners and occupants having septic tanks to take the responsibility of operating and maintaining them appropriately. Under the previous legal arrangement, IWK had no right to oblige the users to pay desludging costs and sewerage charges, or to impose a fine on them. The new act features the integration of drinking water and sewerage services. This holistic approach to water management enables enforcement and water supply cut on users who do not pay sewerage charges. This framework also reinforced SSD's roles and provided by law a new regulator, SPAN (Suruhanjaya Perkhidmatan Air Negara or National Water Services Commission).

SSD became a project implementation agency, in charge of defining the planning for new constructions and upgrades of sewers and wastewater treatment plants. Through the monitoring and regulation of sewerage services, SPAN follows the performance of IWK. To improve the quality of new systems constructed by the private sector, SPAN provides them guidelines to ensure that new facilities are built according to the standards set and that the effluent would be able to meet the quality requirements determined by the Department of Environment. Accordingly, the developers must select any of the systems that are approved by SPAN.

One of Malaysian sanitation characteristics is that sewerage systems and septic tanks are equally considered to contribute to the improvement of sanitation regardless of whether they are constructed by the public sector or the private sector. Therefore, based on this concept, both systems' regulation, operation and maintenance are provided by the same organizations.

The ratio of connected houses to the sewerage system was 5 percent in 1993, but it drastically increased to reach about 70 percent in 2010. Furthermore, the number of wastewater treatment plants that conform to the standards for discharged effluent increased year after year. In 2006, 69 percent of wastewater treatment plants met the BOD standard and 88 percent of them complied with the SS standard.

### (3) Present wastewater management in Malaysia

1) Classification of wastewater treatment facilities[6)]

Table 2 shows the classification of public and private wastewater systems that treats grey and black water through proper treatment facilities or septic tanks.

IWK operates and maintains about 5,800 wastewater treatment facilities all over the country, which cover a population equivalent (PE) of 19,500,000 people (2010). In the past, a communal septic tank

used for an apartment was regarded as a wastewater treatment plant, but it now falls under the same category as an individual household septic tank. In 2010, it was estimated that their number reached around 1,255,000 to cover 6,3900,000 population equivalent.

In moving forward in the reconstruction, expansion and new implementations of wastewater treatment facilities, in accordance with the Sewerage Catchment Strategy, it can be estimated that the activated sludge process, or similar processes that can be easily modified to achieve advanced treatment, will prevail. By doing so, septic tanks are gradually expected to decrease in urban areas.

Table 2: Classification of wastewater treatment facilities in Malay Peninsula (December 2008)

| Wastewater Treatment Facilities | Quantity/Length | Population Equivalent (PE) |
|---|---|---|
| Regional STPs (Public) | 74 | 5,600,000 |
| Multipoint STPs (Public) | 5,148 | 12,300,000 |
| Pumping Stations (PS) | 668 | 3,600,000 |
| Private STPs | 3,415* | 2,000,000* |
| Communal Septic Tanks (CST) | 3,635 | 434,000 |
| Individual Septic Tanks (IST) | 1,100,000 | 5,500,000 |
| Pour flush (PF) | 761,000 | 3,800,000 |
| Sludge Treatment Facilities (STF) | 40 | — |
| Sewer Networks (km) | 14, 000 | — |

*based on identified Private Plants

2) Capacity of the wastewater treatment process

IWK reported the characteristics of raw wastewater as follows: 200 mg/L < BOD < 400 mg/L and 200 mg/L < SS < 350 mg/L.

Table 3 shows the relationship between treatment processes and the quality of treated wastewater.

Table 3: Relationship between treatment processes and the quality of treated wastewater

| Treatment process | | Effluent quality | |
|---|---|---|---|
| | | BOD (mg/L) | SS (mg/L) |
| Activated sludge process or similar treatment process | | 10-30 | 15-40 |
| Aerated lagoon | | 20-80 | 40-100 |
| Stabilization pond process | | 20-100 | 30-150 |
| Imhoff tank | | 50-150 | 30-150 |
| Individual household septic tank | | 150-200 | 50-100 |
| Reference Discharged effluent quality standards | Standard A | 20 | 50 |
| | Standard B | 50 | 100 |

Standard A applies to the upstream side of the water intake.

3) Environmental standards for river water quality

In 1985, the Department of Environment classified the quality of river water into six classes. Table 4 shows environmental standards on a class basis.

Table 4: Environmental standards for the quality of river water

| Parameters | (Units) | Classes | | | | | |
|---|---|---|---|---|---|---|---|
| | | I | IIA | IIB | III | IV | V |
| DO | mg/l | 7 | 5 - 7 | 5 - 7 | 3 - 5 | < 3 | < 1 |
| COD | mg/l | 10 | 25 | 25 | 50 | 100 | > 100 |
| BOD | mg/l | 1 | 3 | 3 | 6 | 12 | > 12 |
| Total Dissolved Solids | mg/l | 500 | 1000 | - | - | 4000 | - |
| Total Suspended Solids | mg/l | 25 | 50 | 50 | 150 | 300 | > 300 |
| Faecal Caliform | counts/100 ml | 10 | 100 | 400 | 5000 | 5000 | - |
| Total Coliform | counts/100 ml | 100 | 5000 | 5000 | 5000 | 5000 | >50000 |

4) Water quality standards for discharged wastewater

Tables 5 to 7 show quality standards for wastewater discharged from treatment facilities based on the Environmental Standards for Water Quality enforced in 2009.

Table 5 indicates quality standards for wastewater discharged from new treatment plants. Table 6 presents the standards permitted before January 1999 while Table 7 shows the standards defined after January 1999. As shown in Tables 5, 6, and 7, a stricter value applies to the facilities constructed recently.

Table 5: Quality standards for wastewater discharged from new treatment plants

APPENDIX K1

**Extracted from Environmental Quality (Sewage) Regulations 2009 (PU(A) 432)**

**SECOND SCHEDULE**
**(Regulation 7)**
**ACCEPTABLE CONDITIONS OF SEWAGE DISCHARGE OF STANDARDS A AND B**

**(i) New sewage treatment system**

| | Parameter | Unit | Standard A | Standard B |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| (a) | Temperature | °C | 40 | 40 |
| (b) | pH Value | - | 6.0-9.0 | 5.5-9.0 |
| (c) | BOD5 at 20°C | mg/L | 20 | 50 |
| (d) | COD | mg/L | 120 | 200 |
| (e) | Suspended Solids | mg/L | 50 | 100 |
| (f) | Oil and Grease | mg/L | 5.0 | 10.0 |
| (g) | Ammonical Nitrogen (enclosed water body) | mg/L | 5.0 | 5.0 |
| (h) | Ammonical Nitrogen (river) | mg/L | 10.0 | 20.0 |
| (i) | Nitrate – Nitrogen (river) | mg/L | 20.0 | 50.0 |
| (j) | Nitrate – Nitrogen (enclosed water body) | mg/L | 10.0 | 10.0 |
| (k) | Phosphorous (enclosed water body) | mg/L | 5.0 | 10.0 |

Note : Standard A is applicable to discharges into any inland waters within catchment areas listed in the Third Schedule, while Standard B is applicable to any other inland waters or Malaysian waters.

Table 6: Quality standards for wastewater discharged from treatment facilities approved before January 1999

**APPENDIX K1**

**(ii) Existing sewage treatment system (approved before January 1999)**

This category refers to all sewerage treatment systems which were approved before the Guidelines for Developers: Sewerage Treatment Vol. IV, 2nd edition and were enforced by the Department of Sewerage Service, Ministry of Housing and Local Government, beginning January 1999. Below are the acceptable conditions for sewerage discharge according to type of sewage treatment systems:

| | | | Type of Sewage Treatment System | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Communal Septic Tank | Imhoff Tank | | Aerated Lagoon | | Oxidation Pond | | Mechanical System | |
| | Parameter | Unit | A | B | A | B | A | B | A | B | A | B |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| (a) | $BOD_5$ at 20°C | mg/L | 200 | 200 | 175 | 175 | 100 | 100 | 120 | 120 | 60 | 60 |
| (b) | COD | mg/L | - | - | - | - | 300 | 300 | 360 | 360 | 180 | 240 |
| (c) | Suspended Solids | mg/L | 180 | 180 | 150 | 150 | 120 | 120 | 150 | 150 | 100 | 120 |
| (d) | Oil and Grease | mg/L | - | - | - | - | - | - | - | - | 20 | 20 |
| (e) | Ammoniacal Nitrogen | mg/L | - | - | 100 | 100 | 80 | 80 | 70 | 70 | 60 | 60 |

Note :

1. Standard A is applicable to discharge into any inland waters within catchment areas listed in the Third Schedule, while Standard B is applicable to any other inland water or Malaysian waters.

2. These standards are applicable to the sewerage treatment systems that may have been constructed prior to 1999 based upon approval given by other agency, other than the Department of Sewerage Services, Ministry of Housing and Local Government.

Table 7: Quality standards for wastewater discharged from treatment facilities approved after January 1999

**APPENDIX K1**

**(iii) Existing sewage treatment system (approved after January 1999)**

All sewerage treatment systems which were approved after the Guidelines for Developers: Sewerage Treatment Vol. IV, 2nd edition and were enforced by the Department of Sewerage Service, Ministry of Housing and Local Government, beginning January 1999 and up to date of coming into operation of these Regulations.

| | | Standard | |
|---|---|---|---|
| *Parameter* | *Unit* | A | B |
| (a) $BOD_5$ at 20°C | mg/L | 20 | 50 |
| (b) COD | mg/L | 120 | 200 |
| (c) Suspended Solids | mg/L | 50 | 100 |
| (d) Oil and Grease | mg/L | 20 | 20 |
| (e) Ammoniacal Nitrogen | mg/L | 50 | 50 |

Note:

Standard A is applicable to discharge into any inland waters within catchment areas listed in the Third Schedule, while Standard B is applicable to any other inland waters or Malaysian waters.

5) Quality of river water

Malaysia has constructed a vast number of wastewater treatment plants and enforced quality standards for river water and wastewater discharged from such facilities. However, as shown in the figure below, the river water quality has degraded in recent years.

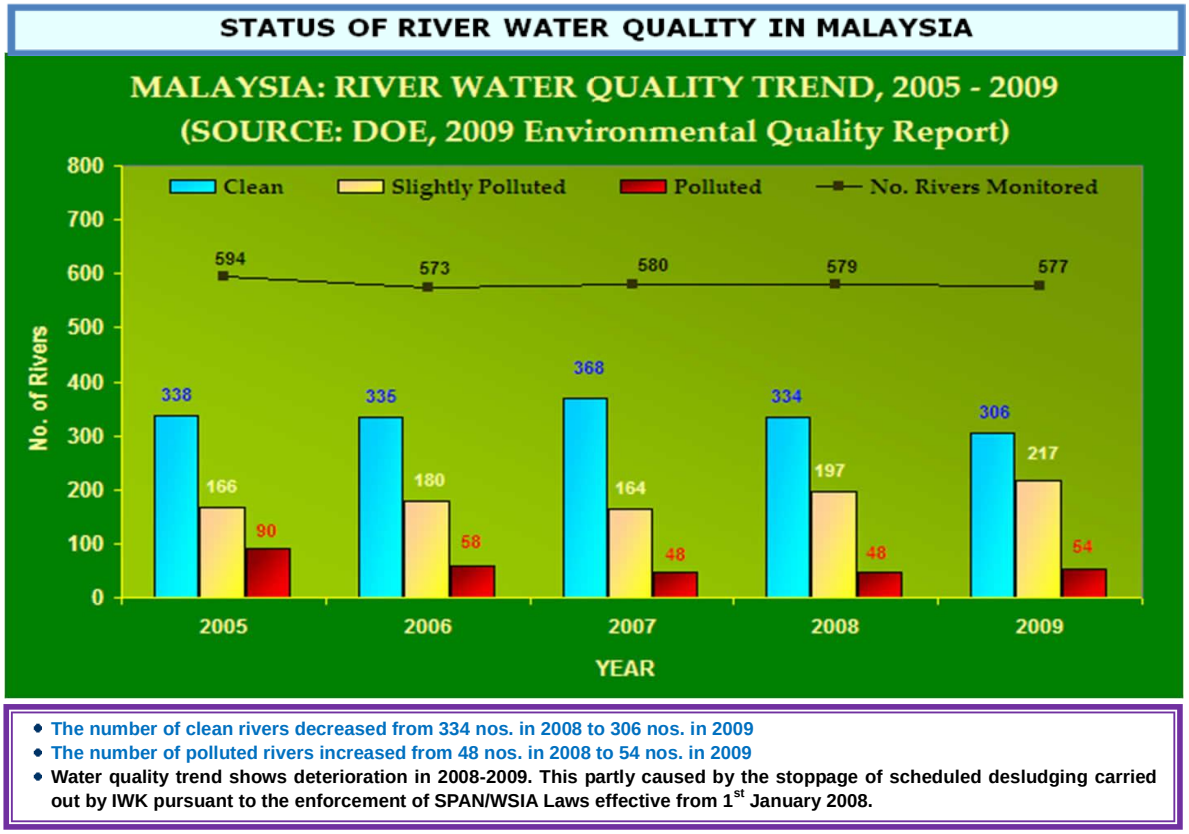


Figure 3: Trends in river water quality in Malaysia

## (4) Sewerage finance in Malaysia

4.1) Sewerage charges

The accompanying table shows public utility charges in Malaysia, which are derived from collected data.

| Utility type | Ringgit/house/month (1 ringgit ≈ 27 yen) |
|---|---|
| Drinking water | 40 |
| Electricity | 80 |
| Telephone | 150 |
| Wastewater | 8 (1/5 that of drinking water and 1/10 that of electricity) |

4.2) IWK's operation

Since 2000 when the government took over IWK's operation, the collection ratio of sewerage charges has officially increased from 65 to 85 percent. The citizens seem more satisfied with sewerage services,

resulting in the indication of a stronger intention to pay the charge. Nevertheless, government's financial contribution to IWK is still important.

Formally, the government provides 10 percent of IWK's budget and the remainder is covered by the sewerage charges. However, as the subsidies from the government are not sufficient to cover IWK's deficit, this organization makes a request for 300 million ringgit every year. Nonetheless, only about one-third of the requested funds are provided to IWK. Few reasons can be put forward to explain why the government needs to finance in such way IWK.

Firstly, sewerage charges are probably not collected as announced, which requires conducting PR activities for letting the residents understand the necessity of good sanitation and for payment.

Secondly, sewerage charges are too low (the tariff will probably not be raised before any general election). In its wish to gradually reduce subsidies given to IWK, the government is considering new strategies for increasing the collection ratio of sewerage charges and reducing operational expenditures from IWK. This is why IWK is now asked to only focus on the managerial aspects of wastewater treatment facilities and no longer to invest for the development of new sewerage infrastructure. The integration of water supply and sewerage services in a same bill will make possible to stop water supply to home users who pay no sewerage charge. While the tariffs for sewerage services need to be raised, IWK shall strive to reduce operation and maintenance costs.

### (5) Maintenance of Wastewater Treatment Facilities

Malaysia has 144 local governments, and wastewater treatment facilities under the control of 86 local governments. These are maintained by IWK with 2,800 employees.

IWK collects sludge from 40 percent of more than 1.2 million septic tanks in Malaysia (2010), raises resident's awareness on sanitation and the importance of properly maintaining septic tanks through PR and educational activities to encourage septic tanks owners/users to make requests and pay for regular desludging service. IWK also puts efforts in environmental education and human resource training in neighboring countries, including Indonesia, Vietnam, and Philippines.

IWK's income includes sewerage charges and desludging fees from septic tanks, but the former collection ratio reaches probably only about 50 percent and sewerage charges have been left unchanged for the past 17 years at a low standard. Accordingly, IWK carries on services while relying on subsidies from the government.

## 3. Grants-in-Aid from Overseas Aid Agencies and a Tour of Wastewater Treatment Plants

As of now, Malaysia has a per capita GDP of about US$8,300 (2010), which is already higher than the GDP of other Southeast Asian countries, so support from overseas aid agencies including JICA are reducing.

Japanese assistance to Malaysia in the past ten years includes a contract for the 18th yen-loan "Nationwide Wastewater Treatment Project" with an upper limit of about 48.5 billion yen between the Japan Bank for International Cooperation and the Malaysian government signed in March 2000.

The purposes of this project were to construct wastewater treatment plants in 13 locations to reduce the pollution load of wastewater by 90 percent and to let about 2.8 million residents benefit from the resulting facilities. Japanese companies (including a general constructor and a plant maker) won the

international tender. Some of the plants include advanced treatment equipment such as a denitrificator.

The JSC team took a tour of the following two plants, which were constructed through this project.

### 3.1 Bunus Centralized Sewage Treatment Plant (Kuala Lumpur)

#### (1) Outline of the plant

- This plant upgraded from the conventional aerated lagoon process to the two-step inflow nitrification and denitrification process. Presently, it covers a population of 352,000 people equivalent and has an average throughput of 87,000 $m^3$/day (250 L/person/day on average). The former and latter will reach 800,000 people equivalent and 198,000 $m^3$/day in the future.

- The planned quality of treated wastewater is as follows: BOD = 20 mg/L, SS = 40 mg/L, T-N = 10 mg/L, and $NH_4$-N = 2 mg/L.

- The plant has a disinfector but carries out no sterilization because of lack of legal requirements. At the time of the visit, IWK declared that water is sterilized only when a water-derived infectious disease is found. Note that sterilization is mandatory in the case of drinking water.

#### (2) Wastewater treatment process

- The plant employs the two-step inflow nitrification and denitrification process (anoxic, aerobic, anoxic and aerobic) to remove nitrogen. It includes eight water treatment lines. The mean MLSS and planned HRT of the aerobic tank are 2,000 mg/L and 10 hours, respectively. The HRT of the final sedimentation pond is 2 hours. The anoxic and aerobic tanks attain DO < 0.5 mg/L and DO > 1.5 mg/L, respectively.

#### (3) Sludge treatment process

- For excess sludge, polymer is added. The mixture is concentrated with a drum-type thickener to reduce SS to about 2-4 percent, early settled sludge with an SS of 2-3 percent is added, and the mixture is methane-fermented in a middle-temperature digestion tank for 30 days.

  The volume of biogas generated is 2,500 $m^3$/day, and its $CH_4$ content is 60-65 percent. All the methane gas is currently burned without effective use, but future gas power generation is being investigated. Digested sludge is dewatered to reduce the moisture content to 82 percent and then landfilled.

### 3.2 Southern Klang Valley Sludge Treatment Plant (Klang Valley District, Selangor State)

#### (1) Outline of the plant

- The plant was constructed to treat septage and wastewater from neighboring houses.

  IWK dispatches six staffs to operate the plant, in addition to the staff in charge of sewer maintenance and sludge extraction from septic tanks. IWK announces that the plant has completed the first-phase construction and will be expanded in the future. The current and future planned throughputs of wastewater are 5,400 $m^3$/day and 16,000 $m^3$/day, respectively.

### (2) Septage treatment process

- The treatment flow consists of discharging septage from a vacuum truck, filtering with a coarse screen, filtering with a fine screen, lifting septage with a screw pump, concentrating it in a storage tank, dewatering it with a screw press (the moisture content of the cake is 80%), and disposing it in a landfill.

  After dehydration and filtration, BOD is 5,000 mg/L. The site for disposal of the dewatered cake is owned by a private company.

### (3) Wastewater treatment process

The plant employs the three-step inflow nitrification and denitrification process.

In the Pantai Wastewater Treatment Plant, the stabilization pond will be renewed during the second-phase construction plan, following the first phase that was implemented with the aid of ODA. Chinese companies provide part of the financial support and construction.

## 4. WATER SECTOR REFORMS IN MALAYSIA

### (1) Problems in the water supply and sewerage sectors in Malaysia

1) Each state government operates the waterworks. The positive introduction of PPP (e.g. purification plant building based on BOT) accelerated the construction of waterworks, resulting in a drinking water coverage of 100 percent. However, there are some problems: for example, the low efficiency of the water supply management results in a high ratio of unaccounted-for water (35% in average). In addition, water charges are generally still low, enabling the coverage of the maintenance cost but not the facility construction cost. Therefore, many state operators borrow funds from the government for plant construction, and the accumulated debts prevent efficiency improvement. In addition, there are many failed PPP plans.

2) Although the transfer of all sewerage assets to IWK for management and development resulted in drastically increasing sewerage coverage throughout Malaysia, ineffective cost recovery due to the low tariffs of sewerage charges and probably to their insufficient collection rate necessitates – even after IWK's nationalization in 2000 – additional subsidies from the Federal Government.

3) Separating the operation of water supply and sewerage makes it difficult to cut water supply as one measure against the nonpayment of sewerage charges.

### (2) Structural reform of the Malaysian water supply and sewerage sectors

In 2006, the Parliament approved the Water Services Industry Act 2006 as a new law and the establishment of National Water Service Commission (SPAN) as a regulatory body of water supply and sewerage sector. In 2008, the former was in effect and the latter started.

(Waterworks)
With the new law, each state government transfers its waterworks to PAAB, a government-owned asset holding company, which leases these assets to state-by-state water operators (state-managed or private company) licensed by SPAN. As a result, PAAB receives leasing fees. SPAN checks the operators for

performance according to its own key performance indicators. SPAN has the right to revoke the license from operators who show unsatisfactory performance.

(Sewerage)
Concerning the sewerage, SSD transfers its regulatory function to SPAN. The former works as a project implementation agency (managing funding for facility construction/renewal), the latter regulates them, and IWK maintains the facilities.

The structural reform of the Malaysian water supply and sewerage sectors aims at the following objectives:

1) To improve the efficiency of the operators. A new system has been introduced in which SPAN has been established as a regulatory body for water supply and sewerage. With this system, the performance of the operators is monitored according to key performance indicators defined by SPAN.

2) To separate asset possession and operation/maintenance in waterworks and sewerage, and to let a government-owned asset holding company control the assets to manage the investment for the construction of facilities. The federal government assumes debts for water services accumulated by the local governments to reduce their load and to make the water utility more efficient. It also introduces private funds in place of ODA and taxes into facility construction. The asset holding company for drinking water has already started and the one for sewerage will be established within several years.

3) To apply the same strategy to sewerage as waterworks, which are operated and maintained on a state level, IWK will be divided into state-by-state operators. Operation and maintenance of water supply and sewerage services will be managed by a same company at the state level. Currently, outside the states of Sabah and Sarawak, IWK monopolizes the operation and maintenance of sewerage systems in urban areas except in Johor City. In the future, a principle of competition will be introduced into the operation and maintenance field.

4) Many residents pay no sewerage charge. The structural reform mentioned above aims to enable the interruption of water supply as one of the measures against such issue through the integration of waterworks and sewerage.

5) To increase sewerage charges.

**(3) Impacts of the structural reform of the Malaysian water supply and sewerage sectors and PPP**

In water utility, the introduction of past BOT-based PPP does apparently not result in the improvement of the state-by-state operator's efficiency.

Unaccounted-for water ratio is still high, and BOT companies in some states have realized a profit but the state drinking water corporations suffer from deficit. In addition, there are many failed PPP projects. Accordingly, the policy of the federal government does not approve new concessions. On the other hand, separating asset possession and operation and maintenance may allow private companies to join the latter field easily.

In the wastewater treatment field, the structural reform mentioned above enables private companies to be involved in the operation and maintenance of sewerage formerly monopolized by IWK. Actually in Johor City, Ranhill, a Malaysian private company, already operates and maintains the waterworks, and

the city government operates and maintains the sewerage, but the former hopes the latter work. Therefore, the federal government has had an argument about whether to permit it. If Ranhill would be allowed for sewerage operation and maintenance, the same situation could occur in other states.

Foreign companies can conduct the operation and maintenance of water or sewerage facilities, but there are restrictions on stockholding—not less than 70 percent their employees shall be Malaysian.

## 5. SEPTAGE MANAGEMENT IN MALAYSIA

### (1) Present state

To ensure that all buildings have a connection to a wastewater treatment system, each new construction needs to obtain a certificate of fitness (CF) issued by the Sewerage Services Department (SSD) until 2008, and later by SPAN. This certification applies not only to wastewater treatment facilities but also to waterworks, to ensure that all the facilities conform to Malaysian Guidelines.

Wastewater is now treated mainly by sewerage facilities, but many houses and communities have septic tanks, from which sludge needs to be regularly collected. In 2010, Malaysia had 1.2 million individual septic tanks and 4,300 communal septic tanks, which covered 6.4 million and 0.5 million population equivalent, respectively. These figures keep growing as private developers are still providing individual septic tanks with new constructions. There are currently 16 private companies licensed by SPAN to manufacture septic tanks in Malaysia. In addition, the population equivalent using pour-flush toilets reaches more than 4.4 million (about 15.8% of the total population).

In 1993, regular sludge extraction started when IWK was entrusted for sewerage services and septage management. Before that, sludge was collected from only 2 percent (about 300,000 units) of the existing septic tanks. To implement scheduled desludging by geographic area, IWK developed over several years a database of septic tanks from field mapping and on-call desludging requests. This data is stored in a system called “Customer Operational Enquiry and Desludging System (COEDS).” In this system, the Customer Service Department of IWK informs the residents living in a specific area of when sludge is to be extracted, and the users reply with a desired date. After sludge collection, a written work confirmation is issued in which customers can evaluate the service received. A given fee shall be paid for scheduled desludging once every six months and for on-call desludging immediately after the work.

For a communal septic tank, the owner shall pay the desludging fee in the same fashion as individual septic tanks. For individual premises or houses connected to a septic tank, the fee ranges from 2 to 6 ringgit/month. For on-call service (for example in areas not covered by the scheduled desludging program), the fee is 180-360 ringgit (US$60-120), providing that the tank capacity does not exceed 2.5 $m^3$.

IWK’s scheduled desludging program started and drastically increased the percentage of desludged septic tanks from 2 percent of 302,800 units (1993) to 58 percent of 938,886 units (2001). However, only about half of the septic tanks in the target areas participated in regular desludging until 2008. Gradually, an increasing number of tank owners showed unwillingness to pay the desludging fee and contacted a sludge extractor only when their tanks had trouble. Although desludging is required by law, SSD and later SPAN could not enforce it. As a result, the quality of river water is steadily degrading in recent years. Figure 3 (presented before) shows trends in river water quality.

To tackle this issue, the government has adopted a new policy for desludging, while gradually increasing

large-scale sewerage coverage to connect public sewerage to all existing small-scale systems. Since 1st January 2008, it is no longer IWK's responsibility to conduct scheduled desludging but the owner of premises with septic tanks to ensure that maintenance is done. Under the latest legal arrangement, sludge must be collected once every three years either by IWK or a private contractor holding a permit from SPAN. The tariff is regulated and must not exceed US$106 for a septic tank with a capacity of $2m^3$. This fee includes collection and treatment costs. If septic tanks are not desludged within three (3) years, owners can be fined up to 50,000 Ringgit (about US$16,500). Under WSIA, the fines for non-compliance have significantly been raised to oblige owners to comply with their desludging duty and pay for sewerage services in covered areas. Future plans aim for stricter enforcement measures when water and sewerage services will be integrated and managed by the same operator at state level.

## 6. WORKING ON THE IMPROVEMENT OF THE SEWERAGE SYSTEM

### (1) Problems to be solved in the Malaysian sewerage system (including pending ones)

The hearing results show the current problems as follows:

1) Making management more efficient
   (i) Centralizing sewerage systems
   (ii) Increasing the ratio of sewerage charge collection
   (iii) Reviewing the organizational system

2) Further improving water quality in public water bodies

### (2) Sewerage system to be proposed by Japan

In consideration of a rise in Malaysian GDP, an increase in future population, urbanization, measures for further improving the quality of water in public water bodies, and the promotion of centralized treatment of wastewater from small-scale sewerage according to the sewerage catchment strategy, we advise Malaysia to take measures for removing nitrogen and phosphorous in order to preserve water quality. We also recommend promoting applications for reusing treated wastewater with membrane separation technology in order to prevent water shortages.

Currently, Malaysia does not conduct enough investigation for the reuse of sludge and in some wastewater treatment plants, sludge is treated anaerobically (methane fermentation) but the resulting biogas is only burned. We encourage Malaysia to work on biogas power generation for reusing resources while centralizing small-scale sewerage. In addition, urbanization will require the reconsideration of sludge disposal (dewatered cake) in landfills and further reduction of sludge.

From an institutional aspect, we think that Malaysia should introduce a system similar to Japan's total pollutant load regulation in order to improve water quality in public water bodies.

**REFERENCES**


A) Sewerage Services Act approved by the Assembly in 1993
SEWERAGE SERVICES ACT 1993
http://www.agc.gov.my/Akta/Vol.%2011/Act%20508.pdf

B) Water Services Industry Act approved by the Assembly in 2006 and enforced in 2008
WATER SERVICES INDUSTRY ACT 2006
http://www.agc.gov.my/Akta/Vol.%2014/Act%20655.pdf


**SOURCES**


1) Information on Malaysia provided by the Ministry of Foreign Affairs of Japan
http://www.mofa.go.jp/mofaj/area/malaysia/

2) Datuk Ir. Abdul Kadir Mohd Din: "Transforming the Wastewater Industry- Malaysia's Experience", 2nd ADB－DMC and Partners Sanitation Dialogue, Manila, Philippines, 23 -25 May 2011

3) Datuk Ir. Abdul Kadir Mohd Din and Ir. Mohd Haniffa Abdul Hamid: "Frontiers of Urban Sanitation Solutions-Malaysia's Sewerage Management", 2nd IWA Development Congress & Exhibition, Pioneering Water Solutions in Urbanising Areas, Kuala Lumpur, Malaysia, 21-24 November 2011

4) IWA Water Wiki, Country: Malaysia, Project: Faecal Sludge Management - Malaysia
http://iwawaterwiki.org/xwiki/bin/view/Articles/Faecal+Sludge+Management+%252D+Malaysia

5) Mohd Ridhuan, Ismail, National Water Services Commission, Malaysia, "Sanitation Policies & Initiatives in Malaysia", ADBI-JSWA-JSC Regional Workshop on Sanitation in Asia-Pacific, 4-6 September 2011, Tokyo, Japan

6) Ir. Haniffa Hamid, Ir. Dorai Narayana & S. Anusuyah Bai (Indah Water Konsortium Sdn Bhd), "Centralized and Decentralized Wastewater Management in Malaysia – Experiences and Challenges (Part 1)", Ingenieur, p.18-23, Vol. 42, June – August, 2009

7) http://www.iwk.my/sewerage-fact.htm

8) http://www.did.sarawak.gov.my/wqis/sgsarawak/water-qua-standard.htm

9) Department of Environment, Ministry of Natural Resources and Environment, "Environmental Requirements: A Guide For Investors, Eleventh Edition, October 2010

10) IWK material
http://web6.bernama.com/client/iwk/faq.php

11) Documents announced by the Embassy of Japan in Malaysia
http://www.my.emb-japan.go.jp/Japanese/bilateral/sewage/081202.html

12) A Rapid Assessment of Septage Management in Asia, USAID, Eawag, WaterLinks. Country Assessment, Malaysia, pp. 63-76., Jan. 2010.
http://pdf.usaid.gov/pdf_docs/PNADS118.pdf

13) Malaysia Water Industry Guide 2011

14) Progress on Sanitation and Drinking Water (2010 Update), WHO – UNICEF, p. 45

15) Malaysia's Sewerage Needs Integration, Asian Water, January/February 2008, p. 11

16) Malaysia's Water Vision: The Way Forward – The Malaysian Water Partnership.
http://www.fao.org/DOCREP/004/AB776E/ab776e02.htm

17) "Towards Sustainable Sewerage Development - *Sharing Malaysia's Experiences For Replication",* by: Ir. Abd. Kadir Mohd. Din, CEO of IWK. 6th Ministerial Conference on Environment and

Development in Asia and the Pacific (MCED-6), Asthana, Kazakhstan, 27 Sept. to 2 Oct. 2010. http://www.unescap.org/mced6/side_events/documents/eeei/MCKadir-Malaysia.pdf

18) "Overview of the Water Services Industry in Malaysia", by Mdm. Nor 'Aini Abdul Wahab', Deputy Secretary - General (Green Technology and Water), Ministry of Energy, Green Technology and Water, Malaysia. Ministry of Land, Infrastructure, Transport and Tourism, Japan, 14 Feb. 2011.

19) Malaysia, Achieving the Millennium Development Goals, Success and Challenges. United Nations Country Team Malaysia, Economic Planning Unit, Prime Minister's Department, Malaysia, p. 186-188 Jan. 2005. http://www.epu.gov.my/html/themes/epu/images/common/pdf/publication/UNDP1.pdf

20) Climate Change Country Profile: Malaysia, WHO. http://www.wpro.who.int/NR/rdonlyres/3FB0A304-554E-4637-A3A0-3443036E56BC/0/MAA.pdf

21) Water Supply and Sanitation in Malaysia, Wikipedia, the free encyclopedia. http://en.wikipedia.org/wiki/Water_supply_and_sanitation_in_Malaysia

22) Malaysia: Health Profile. WHO, 2011. http://www.wpro.who.int/countries/maa/2011/

23) Water and Sanitation Diseases and the Environment: Challenges, Interventions and Preventive Measures, Scaling Up Sanitation: The Case of Malaysia, pp. 253-255. Janine M. H. Selendy. Wiley-Blackwell, Horizon International. http://books.google.co.jp/books?id=lOEzK5bqGP0C&pg=PA474&lpg=PA474&dq=Water+and+Sanitation+Diseases+and+the+Environment:+Challenges,+Interventions+and+Preventive+Measures,+Scaling+Up+Sanitation&source=bl&ots=_QeW6p9I04&sig=zWSlEkoyhmzGgp1RDZuAxje3M3k&hl=en&sa=X&ei=B4QrT7GSCuqZmQX73ujNDw&redir_esc=y#v=onepage&q=Water%20and%20Sanitation%20Diseases%20and%20the%20Environment%3A%20Challenges%2C%20Interventions%20and%20Preventive%20Measures%2C%20Scaling%20Up%20Sanitation&f=false

**MEETINGS IN MALAYSIA**

I) Meeting with Mr. Engku Azman, Senior Deputy Director (Regulatory), Ministry of Health, Malaysia. 22 Nov. 2011.

II) Meeting with Mohd Ridhuan Bin Ismail, Executive Director, SPAN, Malaysia. Oct, 22, 25 Nov. 2011.

III) Meeting with Ahmad Budaya Bin Ismail, Senior Executive Communications Department, and Bazli Bin Hamzah, Klang Sludge Treatment Plant Unit Manager, IWK, Malaysia. 24 Nov. 2011.

IV) Meeting with Mr. Hamad Rozian, Ministry of Energy, Green Technology and Water, Malaysia. 25 Nov. 2011.