SEWERAGE INDUSTRY IN MALAYSIA – THE WAY FORWARD

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INTRODUCTION

Sewage is generated mainly from domestic activities, either from households, institutions, commercial areas, government complexes, or industrial premises. This includes all discharges from toilets, household washings, kitchen, laundrette, bathrooms, showers, i.e. all domestic or human-related activities.

Jurutera presents the development of the sewerage industry over the years both pre- and post-privatisation era. This article also emphasises on the quality of sewerage system design and construction and hence, highlights the need to overcome the current shortcomings via transparent education of the sewerage industry and in particular, of the engineering fraternity.

EVOLUTION OF SEWERAGE INDUSTRY

Evolution Around the World

In the early days of human civilisation, life was too harsh to worry about sewerage systems. Generally, as the population was very small, nature took care of the sanitation problems. As civilisation started and population increased, the need for proper sanitation arose. In Europe, the development of sewerage systems was due to the development of townships and increasing population.

EVOLUTION IN MALAYSIA

Malaysia has seen the evolution of its sewerage industry over the last half a century. Prior to the country's independence in 1957, there were no proper sewerage systems in Malaya. At that time, there wasn't a need for proper sewage treatment due to the low population densities and very limited urbanised developments. Sewage treatment was mainly by way of primitive methods such as pit and bucket latrines, over-hanging latrines and direct discharge to rivers and seas. When Malaya begun to develop itself and move from an agriculture-based to an industry-based country, the need for proper sanitation arose.

In the 1960s, sewage treatment systems in the form of individual septic tanks and pour flush systems were introduced. Small communal systems engaging mainly primary treatment, such as the Communal Septic Tanks and Imhoff Tanks also started developing.

In the 1970s, the technology engaged expanded to biological treatment processes in the form of oxidation pond systems utilising natural means of treatment.

Then in the 1980s, mechanised systems were introduced in Malaysia and oxidation ponds started to be converted to aerated lagoon systems. The late 1980s and the 1990s saw the accelerated development of fully mechanised systems in the form of Biological Filters and Activated Sludge Systems. The later part of the 1990s saw efforts concentrated on the control of mechanised systems, which allows for process optimisation of new systems.

Structural crack on a water retaining structure

Collapse of a water retaining structure

This evolution of treatment processes from primitive to primary and then to secondary systems was mainly due to the development of technologies in the sewerage industry. The evolution has also seen the movement from non-mechanical systems to more mechanical and automated systems. New and improved equipment was also continuously being introduced due to technological advancements. This with time has also increased the expectation on environmental standards and the skill level in the design, construction and operations of new sewerage works.

DEVELOPMENT OF SEWERAGE INDUSTRY IN MALAYSIA SINCE 1994

Privatisation of Sewerage Industry

Prior to 1993, sewerage management in Malaysia fell under the jurisdiction of local authorities. The Sewerage Services Act was enacted in 1993 to empower the Federal Government to regulate the sewerage industry. The Department of Sewerage Services was formed under the Ministry of Housing and Local Government, as the regulator of the sewerage industry. A National Concession Company by the name of Indah Water Konsortium Sdn Bhd (IWK) was formed in April 1994 to undertake the management of the sewerage services of the country.

SEWERAGE SYSTEMS IN MALAYSIA

Currently, there are approximately 7,500 public sewage treatment plants and more than 13,000 km of sewers managed by IWK in Malaysia.

Most of the plants are primary treatment systems (62%) but they only serve 10% of the population. About 10% of the plants are oxidation ponds or aerated lagoons, which are partial secondary treatment systems that serve 39% of the population. Mechanised plants (28%), which can provide full secondary treatment, serve 51% of the population. Therefore, most of the pollution loading is being treated up to secondary level (51%), and partial secondary level (39%), and only 10% of the pollution loading is treated to primary level. However the standards to which sludge is treated depends upon the individual plant design which differs very widely.

STANDARDS

For rivers in Malaysia, water quality standards are monitored based on the Interim National River Water Quality Standards. To control the level of pollution in the waterways, two effluent discharge standards were enforced as per Table 1 below:

Table 1: Effluent Standards

Parameter		Standard A		Standard B	
		Upstream of water intake		Downstream of water intake	
		Absolute	Ave	Absolute	Ave
BOD	mg/l	20	10	50	20
SS	mg/l	50	20	100	40

Collapse of an oxidation pond

Collapse of an Aeration Tank

The above are the absolute standard which have been misinterpreted as the value to be adopted in design. Thus, most plants designed prior to 1994 have been designed to give an average effluent of 50 mg/l BOD and 100 mg/l SS for Standard B areas. Most biological systems' performance will fluctuate depending on the incoming flow quality, thus most plants designed prior to 1994 will fail at least 50% of the time due to misinterpretation of the effluent standards.

CONTROLS

In order to ensure all new sewerage developments are designed according to correct interpretation of the effluent standards, and also to ensure consistent quality in sewerage development, the Sewerage Services Department prepared guidelines for developers to follow the requirements. In 1994, the first edition of the guidelines was published in 2 volumes. In 1998, revisions were initiated and the second edition was published in stages, volume by volume. There are 5 volumes of the guidelines:

- Volume 1 – Sewerage Policy for New Developments
- Volume 2 – Sewerage Works Procedures
- Volume 3 – Sewer Networks and Pump Stations
- Volume 4 – Sewage Treatment Plants
- Volume 5 – Septic Tanks

SHORTCOMINGS

Issues Related to Submission and Taking Over

Despite the overall improvement in the sewerage industry, there are still many

shortcomings. For instance, various issues had been encountered by SSD and IWK prior to the taking over of public sewerage systems throughout the country. Many developments have been held or delayed for construction and thus unable to be handed over to the purchasers on time, due to the non-conformance to guidelines as set by the DGSS during the various stages of the submission process for sewerage system approval. The key areas of deficiency in sewerage submission are as follows:

- Submission not in accordance to guidelines.
- Incorrect equipment selection.
- Process design not up to mark.
- Whole life (NPV) concept not observed.
- Poor or no standing supervision by the designer.
- Structural not designed or built to worst conditions.
- Lack of considerations for ground conditions (no soil investigation).
- Poor bedding and jointing for sewers.

ENGINEERING INTEGRITY, ACCOUNTABILITY AND RESPONSIBILITY

The sewerage industry is made up of engineers representing various entities such as the regulator, developer, consultant, designer, design checker, project supervisor, contractor, supplier, equipment manufacturer and the operator. These engineers in their respective capacities should be accountable to the roles they play and should contribute positively to national environmental and social objectives for the overall benefit of the nation.

It is the responsibility of the design engineer that the proposed sewerage works (which includes the sewage treatment plant, pumping station and sewer networks) to be properly planned and designed in accordance to the established code and guidelines. All sewerage systems shall be operator friendly, i.e. fulfilling the requirements for safety and health aspects; ease of maintenance and shall be robust in the long run. Whilst the warranty for the pipe materials are guaranteed by the manufacturer, the structural integrity of sewer networks shall also cover for the geo-technical condition and stability of the foundation. Time, cost and quality of the work shall always be kept in balance not only to the benefit of the paymaster but also to the requirement of the asset's inheritor.

It is also the engineers' responsibility to supervise the sewerage works to ensure the quality of construction and the materials and equipment used are in accordance to specification. Occurrence of undercutting or cutting-corner practiced by some irresponsible parties will lead to poor quality finished works and this is particularly due to the lack of supervision by the supervising engineers. Apart from the obligation for supervision, it is also the responsibility of the engineer to conduct testing of the completed works to ensure that the actual performance is in correspondence to the earlier design assumptions.

STRUCTURE/INFRASTRUCTURE FAILURE

Since taking over sewerage systems from the local authorities, IWK have inherited systems that have major structure or infrastructure failures. Most of the failures are due to the lack of supervision during the construction of the plants and also due to obsolete codes or out-of-date design or construction standards that have been used. Professional monitoring is essential since it will guarantee that a sound structure will be built which conforms to standards and specifications.

DESIGN / PROCESS AND M&E FAILURE

The general trend in the sewerage industry is to subcontract the construction of new STPs to specialist or turnkey sewerage contractors. This means that the specialist will undertake the overall design of the STP including the process, civil, structural, mechanical and electrical portions. However, most of the specialists do not have sufficient expertise to undertake all aspects of the design. For example, they may be an expert in process design but lack civil, structural, mechanical and electrical engineering expertise. In this case, the process system may be perfectly designed but the civil, structural, mechanical and electrical portions have many deficiencies.

Failure of sheet piles

Sewerage system performance depends greatly upon the process concepts and design. The majority of plant failures are due to the mis-coordination between the process concept and equipment selection.

Selection of inappropriate mechanical and electrical components has also resulted in a vast number of plant failures. Equipment and products used in the sewerage industry must be in accordance to the DGSS approved list and feedback from consultants on the performance of these equipment is essential to ensure the continued good performance of sewerage systems.

THE WAY FORWARD

To ensure that previous mistakes will not happen again, stricter controls are recommended for implementation. Every submitting engineer, consultant, system supplier and contractor is

recommended to be registered with the DGSS. The registration of this group of service providers will enable close monitoring process by SSD. This will also help SSD in the process of determining the correct parties to do the remedial works in the event of any failure or break down.

The parties that are involved directly with the sewerage industry also need to enhance their understanding of SSD guidelines more thoroughly. Only competent persons shall be allowed to carry out the submission works.

In order to ensure all environmental aspects are being taken care of, every proposed construction of a new STP needs to have an environmental impact assessment report. The construction and operation of a Municipal Sewage Wastewater Treatment Plant is a Prescribed Activity under the EIA Order, 1987, item 18(c)(i). This report shall be submitted during the initial stage, i.e. the planning stage. Impact on the environment of the constructed STP and the proposed mitigating measures should be clearly cited in the report.

In most cases, the designer tends to neglect the safety and operational aspects of sewage facilities that they design. The designer is responsible for safety as per Occupational Safety and Health Act 1994 (Act 514), Part V (Clause 20). A mandatory requirement to be included in the submission process is a procedural tool to identify the safety and operability deficiencies in the design and operation of a plant. This is called HAZOP. It can be conducted at any project stage to ensure that all hazard and operability issues are captured during the life cycle of the treatment works.

In line with the government approach towards certification of CFO by submitting professionals, engineers practising in the sewerage industry should play their roles in ensuring compliance to regulatory needs and good engineering practice. Engineers should uphold the engineering code of ethics in order to ensure that quality sewerage infrastructure are being constructed in the country. Furthermore, engineers who practise wastewater engineering should ensure that they are continually train to keep themselves up to date in the knowledge of wastewater engineering, in line with the CPD requirements. ■

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