Wastewater Management in Urban Area: Bangkok, Thailand

Wijarn Simachaya
Thiparpa Yolthantham
Pollution Control Department of Thailand
Ministry of Natural Resources and Environment
e-mail: wijam.s@pcd.go.th
Thailand at a Glance

- Thailand is situated in the heart of the Southeast Asian mainland, covering an area of 513,115 sq.km. and extends about 1,620 km from north to south and 775 km from east to west.
- Thailand has a warm, tropical climate affected by a seasonal monsoon.
- Population 64 million and density about 132 people/km².
- Thailand can be divided into 25 river basins. The average of annual rainfall for the country is about 1,700 mm. The available water quantity was about 3,300 m³/capita/year.
1,687 Municipalities

BMA, Pattaya City

(6,089) LAOs

MWW~2.5 Mm³/d

MWW~3.0 Mm³/d

MWW~9.0 Mm³/d

Total MWW~14.5 Mm³/d

The treatment capacity
~3.2 Mm³/d
(~23% of total MWW)

Total BOD Loading
~2,600 Ton BOD/d
Sources of Water Pollution in Thailand

- **Domestic** :
  - 1,687 Municipalities,
  - 6,089 LAOs,
  - BMA, Pattaya City
  - Approximately 14.5 M m³/d

- **Industry** :
  - >120,000 factories
  - Approximately 2.8 M m³/d

- **Agriculture** :
  - Pig farm+ Aquaculture (Point source) 0.1 M m³/d
  - Paddy field (Non-point source) 150 M m³/d
Urban Wastewater Management in Thailand

Urban Wastewater in the country:
- is one of the most serious environment problems.
- approximately 14.5 M m³/day of municipal wastewater generated by the population around the country (2008):
  - (1,687) Municipalities ~ 2.5 M m³/d
  - (6,089) LAOs ~ 9.0 M m³/d
  - BMA, Pattaya City ~ 3.0 M m³/d
- 101 treatment plants in the country have been constructed (approximately 3.2 millions m³/day of the treatment capacity or 23% of total wastewater)
- Major pollutant is organic waste.
### Central Wastewater Treatment

#### Combined Sewer System
- drain both rainfalls and wastewater within one system

#### Separate Sewer System
- the sewerage and drainage are collected in separate piping systems

### Design Criteria for Central Wastewater Treatment

<table>
<thead>
<tr>
<th>The type of collection systems</th>
<th>BOD (mg/l)</th>
<th>SS (mg/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combined Sewer System</td>
<td>65 - 110 (80)</td>
<td>40 – 110 (80)</td>
</tr>
<tr>
<td>Separate Sewer System</td>
<td>(160)</td>
<td>(160)</td>
</tr>
</tbody>
</table>
Status of Municipal Wastewater Treatment Facilities in Thailand

Location of 101 Municipal Wastewater Treatment Facilities in Thailand

- ● Constructed 90 Plants
- ▲ Under Construction 10 Plants
- Delayed (Samutprakan Province) 1 Plant
Situation of Water Quality in Thailand
Situation of Water Quality in Bangkok
Dissolved Oxygen (DO) in the Lower Part of the Chao Phraya River from 1978 to 2009

![Graph showing dissolved oxygen levels from 1978 to 2009 with min, max, and average values. There is a standard of 2 mg/l.](image-url)
Biochemical Oxygen Demand (BOD) in the Lower Part of the Chao Phraya River from 1978 to 2009

![Graph showing Biochemical Oxygen Demand (BOD) from 1978 to 2009. The graph indicates the minimum (Min), maximum (Max), and average (Ave) values of BOD over the years. The graph also highlights the standard deviation (Std.) of 4 mg/l.](image-url)
Current Measures on Water Quality Management in Bangkok

- Implementation of Central Wastewater Treatment Projects
- Improvement of the Community Wastewater Treatment Plants
  - The 12 community wastewater treatment plants from Housing Authority are now being operated by BMA with total capacity of 25,700 m³/day.
- Canal Water Improvements
  - The project provided re-circulation of clean water to the canals and to oxygenate canal water with aerators.
  - Three aerated lagoons systems for primary wastewater treatment in the city are operated.
- Legislation Measures
- Public Relation and Participation
  - Public education and awareness raising
  - Canal clean up activities
  - Community participation e.g. water quality monitoring
## Status of Central Wastewater Treatment Plants in Bangkok

<table>
<thead>
<tr>
<th>Plants</th>
<th>Capacity (m³/day)</th>
<th>Service Areas (km²)</th>
<th>Service Pop Treatment</th>
<th>Technology</th>
<th>Date of Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Si Phraya</td>
<td>30,000</td>
<td>2.7</td>
<td>120,000</td>
<td>Activated Sludge, AS (Contact Stabilization)</td>
<td>Jan 1994</td>
</tr>
<tr>
<td>Chong Nonsee</td>
<td>200,000</td>
<td>28.5</td>
<td>580,000</td>
<td>AS (Cyclic Sludge System)</td>
<td>Dec 1999</td>
</tr>
<tr>
<td>Ratanakosin</td>
<td>40,000</td>
<td>4.1</td>
<td>70,000</td>
<td>Two-Stage AS</td>
<td>May 2000</td>
</tr>
<tr>
<td>Thoong Kru</td>
<td>65,000</td>
<td>42.0</td>
<td>177,000</td>
<td>AS (Vertical Loop Reactor)</td>
<td>February 2002</td>
</tr>
<tr>
<td>Nong Kheam</td>
<td>157,000</td>
<td>44.0</td>
<td>520,000</td>
<td>AS (Vertical Loop Reactor)</td>
<td>February 2002</td>
</tr>
<tr>
<td>Din Deang (Phase I)</td>
<td>350,000</td>
<td>37.0</td>
<td>1,080,000</td>
<td>AS with Nutrient Removal</td>
<td>December 2003</td>
</tr>
<tr>
<td>Chatujak</td>
<td>150,000</td>
<td>33.4</td>
<td>432,500</td>
<td>AS</td>
<td>December 2005</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>992,000</strong></td>
<td><strong>191.7</strong></td>
<td><strong>2,979,500</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Future Development Plan on Water Pollution Control

- **Construction Measures**
  - Three new wastewater treatment plants are to be constructed.

- **Non-Construction Measures**
  - **Legislation Measures**
    - Continue enforce of the effluent wastewater standards
  - **Public Relation Measures**
    - Public participation and awareness raising
  - **Wastewater Discharge Fees**
    - Implementation of the wastewater user charge
  - **Private Sector Participation**
    - Public Private Partnership (PPP) for the management and administration of wastewater facilities
  - **Water Quality Monitoring and Evaluation**
    - Routine water quality monitoring network set up and availability of water quality monitoring data
Conclusion and Recommendations

- Decentralized wastewater management systems would also be useful and appropriate for large and mega cities.

- Sustainable management wastewater reclamation requires synergistic interactions among the government, private sectors and community sectors.

- The lesson learned for the implementation of central wastewater treatment system in Bangkok,
  - Planning in advance and at the same time of city planning
  - Treatment technology depending on available land and the operation and maintenance the system
  - Public awareness and the acceptance of the treatment system to support willing to pay for user charges
  - Law compliance and enforcement for the effluent standards for individual buildings / factories / central wastewater treatment facilities
Conclusion and Recommendations (Cont.)

- Best management practices on water environment management for tropical region should be shared to cover both point and non-point sources pollution.

- Co-benefits approach of water environment management and climate change mitigation should be considered for the 2nd WEPA emerging activities;
  - Biogas production and utilization to reduce methane (GHG) emission from wastewater discharges
  - Wastewater reuse and recycle to land application
THANK YOU

http://www.pcd.go.th