WATER QUALITY (RIVER) MONITORING SYSTEM/PROGRAMME AND POLLUTION CONTROL

By:
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INTRODUCTION TO DOE

- Environmental Quality Act (EQA) - gazetted on 14 March 1974

- 1 April 1975 – EQA came into force

- 15 September 1975 – Establishment of Division of Environment under Ministry of Local Government & Environment

- 1 March 1976 – Division of Environment placed under Ministry of Science, Technology & the Environment

- 1983 – named as Department of Environment

- 27 March 2004 – Department of Environment placed under the newly formed Ministry of Natural Resources & Environment.
Policy Statement:

FOR CONTINUOUS ECONOMIC, SOCIAL & CULTURAL PROGRESS & ENHANCEMENT OF THE QUALITY OF LIFE OF MALAYSIANS, THROUGH ENVIRONMENTALLY SOUND AND SUSTAINABLE DEVELOPMENT
NATIONAL POLICY ON THE ENVIRONMENT

Objectives

- A clean, safe, healthy & productive environment for present & future generations;

- Conservation of the country’s unique & diverse cultural & natural heritage with effective participation by all sectors of society;

- Sustainable lifestyles & patterns of consumption & production
NATIONAL POLICY ON THE ENVIRONMENT

8 Principles

- Stewardship of the Environment
- Conservation of Nature’s Vitality & Diversity
- Continuous Improvement in the Quality of the Environment
- Sustainable Use of Natural Resources
- Integrated Decision-Making
- Role of the Private Sector
- Commitment & Accountability
- Active participation in the International Community
NATIONAL POLICY ON THE ENVIRONMENT

7 Green Strategies

- Education & Awareness
- Effective management of natural resources & the environment
- Integrated development planning & implementation
- Prevention & control of pollution & environmental degradation
- Strengthening administrative & institutional mechanisms
- Proactive approach to regional & global environmental issues
- Formulation & implementation of Action Plans
ENVIRONMENTAL QUALITY ACT, 1974

- 37 subsidiary environmental regulations introduced to deal with specific issues ranging from
  - agro-based and manufacturing industries,
  - air emissions from stationary & mobile sources,
  - noise from motor vehicles
  - management of scheduled wastes
  - environmental impact assessment.

- Planning, design, operation, waste generation & disposal
THE ENVIRONMENTAL QUALITY ACT

Areas of coverage, include:

- Enforcement
- Environmental Monitoring
- Pollution Prevention and Control
- Waste Management
- Environmental Planning
- Environmental Information and Education
- Coordination with States/Countries
PROGRAMMES FOR POLLUTION CONTROL

- Enforcement Programme
- Environmental Monitoring Programme:
  - Air Quality
  - River Water Quality
  - Marine Water Quality
  - Ground Water Quality
- Pollution Prevention/Abatement Programme
  - Environmental Impact Assessment
  - Preliminary Site Evaluation / Site suitability Evaluation (PAT)
  - Written Approval
  - Written Permission
ENFORCEMENT OF THE ENVIRONMENTAL QUALITY ACT 1974
• Environmental management in Malaysia became focused with the gazettement of EQA 1974 on 14 March 1974.

• The Department of Environment's main role is to prevent, control and abate pollution through the enforcement of the EQA 1974, and its 37 subsidiary legislations.
List of Regulations and Orders in the Environmental Quality Act 1974 Related to Water Pollution:

**ACTIVITY - Control of Agro-Based Water Pollution:**

- Environmental Quality (Licensing) Regulations 1977
- Environmental Quality (Prescribed Premises) (Crude Palm Oil) Regulations 1977
- Environmental Quality (Prescribed Premises) (Raw Natural Rubber) Regulations 1978
- Environmental Quality (Prescribed Premises) (Crude Palm Oil) Order 1977
- Environmental Quality (Prescribed Premises) (Raw Natural Rubber) Order 1978
List of Regulations and Orders in the Environmental Quality Act 1974 Related to Water Pollution:

**ACTIVITY - Control of Municipal and Industrial Waste Water Pollution**

- Environmental Quality (Sewage and Industrial Effluents) Regulations 1979
- Environmental Quality (Prohibition on the Use of Controlled Substance in Soap, Synthetic Detergent and Other Cleaning Agents) Order 1995
ENVIRONMENTAL MONITORING PROGRAMME
OBJECTIVE OF MONITORING PROGRAMME

- Fulfill the requirement for DOE to publish an annual report on environmental quality

- To classify the environmental resources
  - Planning for development and utilization of a water resource necessary to classify rivers according to its quality and prospective uses.

- Collection of base-line data
  - To collect necessary data regarding the natural quality of water in order to indicate changes over long duration which may interfere with the present and planned uses of the water resources
Environmental Quality Surveillance
- To assess the effectiveness of wastewater management programmes in the river basins.

Investigating cases of pollution event and providing effective corrective measures
- The information collected may then be used to warn other users of the particular water body about any potential hazard.
RIVER WATER QUALITY MONITORING
RIVER WATER QUALITY MONITORING PROGRAMME

- Started in 1978 to establish baselines and to detect water quality changes in river water quality and has since been extended to identifying of pollution sources as well.

- Water samples are collected at regular intervals from designated stations for in-situ and laboratory analysis to determine its physico-chemical and biological characteristics.

- Water quality monitoring activities were privatized to ASMA (Alam Sekitar Malaysia Sdn Bhd) on 1st January 1995
  - both manual & automatic monitoring
RIVER WATER MONITORING PROGRAMME

(a) Manual Water Quality Monitoring (MWQM) Programme
- In 2006: 1,064 manual stations in 146 river basins were monitored (Thorough review of river basins & monitoring stations in 2004)
- Sampling Frequency = 4 to 12x/yr/station.

(b) Continuous Water Quality Monitoring (CWQM) Programme
Sabah
Sarawak
Peninsular Malaysia

146 River Basins Monitored by DOE
Distribution of DOE Water Quality Monitoring Stations in Peninsular Malaysia

Red flag = stations
Distribution of DOE Water Quality Monitoring Stations in Sarawak and Sabah, Malaysia

Red flag = stations
MANUAL WATER QUALITY MONITORING (MWQM) PROGRAMME

- Parameter for *in-situ* measurement
  - DO (%), DO (mg/l)
  - Turbidity (NTU)
  - Conductivity (Us/cm)
  - Salinity (ppt)
  - pH
  - Temperature

- Parameter for lab analysis - BOD, COD, SS, NH3-N, pH, DS, TS, NO3-N, Cl, PO4-P, O&G, MBAS, E.coli, Coliform, As, Hg, Cd, Cr, Pb, Zn, Ca, Fe, K, Mg, Na. [24 chemical and biological parameters]
CONTINUOUS WATER QUALITY MONITORING

- 15 Automatic water quality monitoring stations on major rivers
  (Sg. Klang, Sg. Linggi, Sg. Melaka, Sg. Sarawak, Sg. Terengganu, Sg. Skudai, Sg. Keratong, Sg. Selangor, Sg. Perak, Sg. Perai, Sg. Labu, Sg. Rajang, Sg. Putat & Sg. Batang Benar).

- Currently installed at sensitive locations including upstream of water abstraction points.
ALAM SEKITAR MALAYSIA SDN BHD CONTINUOUS WATER QUALITY MONITORING STATIONS THROUGHOUT PENINSULAR MALAYSIA-13 STATIONS
ALAM SEKITAR MALAYSIA SDN BHD CONTINUOUS WATER QUALITY MONITORING STATIONS THROUGHOUT EAST MALAYSIA-2 STATIONS
CONTINUOUS WATER QUALITY MONITORING PROGRAMME

- To detect changes in river water quality on a continuous basis.

- Parameters monitored: D.O., Mg & %, NH4, NH3, Conductivity, Turbidity, Salinity, pH, Temperature, Time.

- Water quality levels exceeding the ambient standard for specific parameters will be transmitted real-time to DOE.

- Immediate inspection will be conducted at suspected sites.

- Continuous monitoring is vital for early detection of pollution influx. In 2006 – 2016 incidences of distinctive pollution influx were observed.
TYPES OF WATER QUALITY MONITORING STATION

(a) Baseline stations – located upstream of the catchments / basin, undeveloped area or minimum activities.

(b) Ambient stations – far away, downstream from point/non-point pollution sources. Generally indicates the actual quality of river water.

(c) Impact stations - for enforcement purposes (not included in WQI calculation)
EVALUATION OF WATER QUALITY
EVALUATION OF WATER QUALITY

- Using Water Quality Index (WQI).

- WQI - a method that combined numerous water quality parameters into one concise and objective value representing the state of water quality trends in a river.

- The WQI can be defined as a number on a scale from 0 to 100 that is used to show the water quality.
WATER QUALITY INDEX (WQI)
Water Pollution Index - computed based on 6 main parameters:

(i) **Total Suspended Solids** – as a measure of suspended particulate in rivers;

(ii) **Biochemical Oxygen Demand** – as a measure of organic pollution resulting from agro-based and other industries;

(iii) **Ammoniacal Nitrogen** – as a measure of organic pollution from sewage and animal waste; sewage (human and livestock)
(iv) Chemical Oxygen Demand – as a measure of chemical pollution;

(v) Dissolved Oxygen - construction / mining; DO level should not be below 1ppm.

(vi) pH – measures the amount of acid in water. pH level of 5.5 and lower are particularly at risk.
WATER QUALITY INDEX

\[ \text{WQI} = \left( 0.22 \times SIDO \right) + \left[ 0.19 \times SIBOD \right] + \left[ 0.16 \times SICOD \right] + \left[ 0.15 \times SIAN \right] + \left[ 0.16 \times SISS \right] + \left[ 0.12 \times SIpH \right] \]

- **SIDO** Sub-Index DO (in % saturation)
- **SIBOD** Sub-Index BOD
- **SICOD** Sub-Index COD
- **SIAN** Sub-Index NH₃N
- **SISS** Sub-Index SS
- **SIpH** Sub-Index pH
WATER QUALITY CLASSIFICATION
BASED ON WQI

Status of the river water quality will be given according to the index range

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Index Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Quality Index (WQI)</td>
<td>Clean 81-100, Slightly Polluted 60-80, Polluted 0-59</td>
</tr>
<tr>
<td>Biochemical Oxygen Demand (BOD)</td>
<td>91-100, 80-90, 0-79</td>
</tr>
<tr>
<td>Ammoniacal Nitrogen (NH3-N)</td>
<td>92-100, 71-91, 0-70</td>
</tr>
<tr>
<td>Suspended Solid (SS)</td>
<td>76-100, 70-75, 0-69</td>
</tr>
</tbody>
</table>
NATIONAL WATER QUALITY STANDARDS (NWQS) (MALAYSIA)
- NWQS used for classification of rivers or river segments based on 5 classes of water quality

- NWQS helps DOE to identify problem areas & develop appropriate strategies for water quality management.
River water quality is classified into 6 classes according to the beneficial uses of the river.

<table>
<thead>
<tr>
<th>CLASS</th>
<th>USES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class I</td>
<td>Conservation of natural environment Water Supply 1 – practically no treatment necessary Fishery – very sensitive aquatic species</td>
</tr>
<tr>
<td>Class IIA</td>
<td>Water Supply II – conventional treatment required Fishery II – sensitive aquatic species</td>
</tr>
<tr>
<td>Class IIB</td>
<td>Recreational use with body contact</td>
</tr>
<tr>
<td>Class III</td>
<td>Water supply III – extensive treatment required Fishery III – common, of economic value, and tolerance species; livestock drinking</td>
</tr>
<tr>
<td>Class IV</td>
<td>Irrigation</td>
</tr>
<tr>
<td>Class V</td>
<td>None of the above</td>
</tr>
</tbody>
</table>
### National Water Quality Standards (NWQS)

<table>
<thead>
<tr>
<th>Class Parameter</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOD</td>
<td>&lt;1</td>
<td>1-3</td>
<td>3-6</td>
<td>6-12</td>
<td>&gt;12</td>
</tr>
<tr>
<td>COD</td>
<td>&lt;10</td>
<td>10-25</td>
<td>25-50</td>
<td>50-100</td>
<td>&gt;100</td>
</tr>
<tr>
<td>NH₃N</td>
<td>&lt;0.1</td>
<td>0.1-0.3</td>
<td>0.3-0.9</td>
<td>0.9-2.7</td>
<td>&gt;2.7</td>
</tr>
<tr>
<td>DO</td>
<td>&gt;7</td>
<td>5-7</td>
<td>3-5</td>
<td>1-3</td>
<td>&lt;1</td>
</tr>
<tr>
<td>pH</td>
<td>&gt;7</td>
<td>6-7</td>
<td>5-6</td>
<td>&lt;5</td>
<td>&gt;5</td>
</tr>
<tr>
<td>SS</td>
<td>&lt;25</td>
<td>25-50</td>
<td>50-150</td>
<td>150-300</td>
<td>&gt;300</td>
</tr>
<tr>
<td>WQI</td>
<td>&gt;92.7</td>
<td>76.5-92.7</td>
<td>51.9-76.5</td>
<td>31.0-51.9</td>
<td>&lt;31.0</td>
</tr>
</tbody>
</table>
About 5,256 samples were taken annually, generating over 157,600 water quality data each year.

Data processed and used to calculate Water Quality Index.

Water quality status of each river basin were determined by averaging the WQI from the total stations & sampling frequency every year.
STATUS OF RIVER WATER QUALITY
RIVER WATER QUALITY STATUS (EQR, 2006)

- 146 River Basins:

  - Clean: 80 basins (55%)
  - Slightly Polluted: 59 basins (40%)
  - Polluted: 7 basins (5%)
Malaysia: River Basins Water Quality Trend (1990 - 2006)

(Note: Number of basin monitored changed in 1998)

Yearly water quality trend analysis showing the number of clean, slightly polluted, and polluted basins from 1990 to 2006.
POLLUTED RIVER BASINS (DOE, 2006)

1. Sg. Juru
2. Sg. Pinang
3. Sg. Buloh
4. Sg. Segget
5. Sg. Tebrau
6. Sg. Danga
7. Rivers in Pasir Gudang Area
Map 3 Malaysia: Water Quality Status for River Basins of Sarawak, 2006

Legend:
- **Red**: Polluted
- **Yellow**: Slightly Polluted
- **Blue**: Clean
RIVER POLLUTION PREVENTION
AND
WATER QUALITY IMPROVEMENT PROGRAMME
(PROGRAM PENCEGAHAN PENCEMARAN DAN PENINGKATAN KUALITI AIR SUNGAI - PPPPKAS)
The objectives of this programme are:

- To identify the sources of pollutions and determine the pollution load and its impact in the entire river basin.

- Preparation of action plans to improve the water quality from slightly polluted to clean (Class II) for beneficial use

- To conserve and maintain river water quality status at clean level
RIVER BASIN SELECTED UNDER THE RIVER POLLUTION PREVENTION AND WATER QUALITY IMPROVEMENT PROGRAMME (9th MP)
PPPPKAS COMPONENT

- Detailed study on selected river basins Output:
  (i) Inventory of pollution sources and pollution loads
  (ii) Decision Support System (Water Quality Modeling & Spatial Database of pollution sources)
  (iii) Action Plan for Pollution Prevention & Water Quality Improvement for the selected river basin

- Implementation of Action Plans

- Inventory, Enforcement and Awareness Programme
THANK YOU.