Support Project of Total Pollutant Load Control System (”TPLCS”) introduction

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Ministry of the Environment of JAPAN (MOE Japan)
CONTENTS

1. What is the TPLCS?
2. How to Introduce the TPLCS?
3. Middle-Long term Vision for Enclosed Coastal Sea
4. Support Project for introducing the TPLCS
1. What is the TPLCS?
Character of Enclosed Coastal Seas

Concentration of Industry and Large Population

Industrial Discharge

Increased Pollutant

Sediment degradation

Increased Activities

Household Discharge

Agricultural Discharge

Loss of Fishery, aquaculture, sea-lane, etc.
Red Tide (Bloom of some kind of Phytoplankton)

It usually cause damage on the aquaculture industry.

Photo: Mass mortality of Yellow-tail by Red Tide (Kagawa prefecture)
Anoxic Water Mass (Blue Tide)

Photo: Mass mortality of shellfish by anoxic water (Chiba NGO sanbanze.com)

Mechanism of Blue Tide
The TPLCS is a regulative discharge control system to reduce the total pollutant load that flows into the target water area;

- by setting the target item (COD, N, P)
- by setting the water quality goal
- by setting the total pollutant load at the target year
- by setting effluent levels for each dischargers

The TPLCS requires rationality, fairness, feasibility etc. to be accepted by society at the initial phase.

The TPLCS requires a lot of efforts to manage it.
Expected Effect of the TPLCS

• Promotion of the waste water treatment facilities.
  • To Industry; individual treatment system, etc.
  • To Household; sewerage system and Johkasoh.

• Reduction the land-based pollutant load.

• Improvement of water quality related to eutrophication

• Moderateing the damage to fishery by Red tide, etc.
Pollutant Load ($\text{COD}_{\text{Mn}}$)

**Remarks:** ’14 values = Target Amount

**TPLCS(COD)** put into practice in 1980
COD$_{Mn}$ Distribution (Tokyo Bay)

Occurrence of Red Tides

- Tokyo Bay
- Ise Bay
- Seto Inland Sea

Number of Red Tide Occurrences

Year

'70 '72 '74 '76 '78 '80 '82 '84 '86 '88 '90 '92 '94 '96 '98 '00 '02 '04 '06
2. How to Introduce the TPLCS?
Outline of the TPLC system

Step 1. Screening Process

Step 2. Planning

Step 3. Implementation

Step 4. Monitoring

Step 5. Review & revise
Step 1. Screening Process

◆ Preliminary Survey
   Assess the need of TPLCS
   Eutrophic area?
   Damage to fishery, human, etc.?

Impact Analysis

◆ Designate the TPLCS Area
   Designate the water area need TPLCS.
   Specify the catchment basin.
Step 2. Planning

The Contents of the Reduction Plan

- Water Quality Goal
- Target Year
- Pollutant Load (current, future)
- Regulatory Standard for Reduction (Reduction Goal for Each Sources; each industry sectors)
- Methods for Pollutant Reduction
Step 3. Implementation

Execution of the Reduction Plan

◆ Compliance

◆ Support Program

Financial & Technical Support
Step 4. Monitoring

Execution of the Reduction Plan

- Pollutant Load by each dischargers
  - pollutant concentration
  - effluent flow
- Water quality in targeted water
Step 5. Review & Revise

Review of the Reduction Plan

◆ Analysis & Evaluation the Efficiency of the Reduction Plan

◆ Revise the Plan Periodically
3. Formulation of Middle-Long term Vision for Enclosed Coastal Sea
Hypothesis

Water environment improvement takes much time

Providing a picture of the future goal & its load map is necessary for facilitating public consensus

Desirable water environment target

Matters that should be considered for setting target
- Water usage, geographical characteristic

Requirements
- Easy index for public to understand etc.

Simulation based on Middle-Long term scenarios

New index: Bottom layer DO, Transparency

Formulation of Middle-Long term Vision for Enclosed Coastal Sea
Outline of the simulation model

- **Ecosystem model**: unsteady calculation (water quality, biomass etc.)
- **Elution model**: interaction between bottom sediment and seawater

1. Target calculation areas = TPLCS introduced area in Japan

2. Calculation Period

<table>
<thead>
<tr>
<th></th>
<th>Tokyo Bay</th>
<th>Ise Bay</th>
<th>Seto Inland Sea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Future forecast</td>
<td></td>
<td>2004 (current year)～2034</td>
<td></td>
</tr>
</tbody>
</table>

3. Calculation items

<table>
<thead>
<tr>
<th>Phytoplankton (dinoflagellate, diatom)</th>
<th>Nitrogen (DON, PON, NH$_4^+$, NO$_3^-$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zooplankton</td>
<td>Dissolved Oxygen (DO)</td>
</tr>
<tr>
<td>Carbon (DOC, POC)</td>
<td>Silica</td>
</tr>
<tr>
<td>Phosphorus (DOP, POP, PO$_4^{3-}$)</td>
<td>Suspended Solids (SS)</td>
</tr>
</tbody>
</table>
Output of the simulation (Tokyo Bay)

【COD\textsubscript{Mn}】

2004

2034

75\% value (mg/L)

- 0.0 \sim 1.0
- 1.0 \sim 1.5
- 1.5 \sim 2.0
- 2.0 \sim 2.5
- 2.5 \sim 3.0
- 3.0 \sim 4.0
- 4.0 \sim 6.0
- 6.0 \sim 8.0
- > 8.0

【Transparency】

2004

2034

Yearly average value (m)

- 0 \sim 1
- 1 \sim 2
- 2 \sim 3
- 3 \sim 4
- 4 \sim 5
- 5 \sim 6
- 6 \sim 7
- 7 \sim 8
- 8 \sim 9
- > 9
4. Support Project for introducing the TPLCS by MOE

Concentration of Chlorophyll-a at North-western Pacific Area
Project aimed to Support Implementation the Total Pollutant Load Control System (TPLCS) to East Asian Country

Serious water pollution problems in East Asia

To improve the water quality

Introduce and Implement the TPLCS

2009～2010 Japan-China collaborative research on the TPLC (N, P)

Development of the Guidance for Implementing the TPLCS

Promoting the application to East Asian country
Outline: Guidance for Implementing the TPLCS

1. Importance of the TPLCS
   - What is the TPLCS?
   - Importance of implementation of the TPLCS etc.

2. Execution procedure of the TPLCS
   - Outline of the TPCLS, Individual operation etc.

3. Introduction of systems for operating the TPLCS more efficiently
   - Collaboration and coordination among interested parties
   - How to facilitate pollutant reduction and its compliance

Download
Conclusion

• TPLCS is effectual countermeasures for the east Asian countries that continue the economic development to control the water pollution problem by eutrophication.

• On the other hand, the implementation and execution of TPLCS will be thought to face to many problems.

• MOE developed *TPLCS Implementation Manual* in the support project.

• We expect to revise the manual better reflecting the comments and suggestion from many experts.

• We expect to start joint research for implementing the TPLCS if possible.
Thank you for your listening.

MOE is waiting for your comments to;

mizu-hesasei@env.go.jp
Reference
Eutrophication of Enclosed Water

Discharge from Industry, Household → Inflow of TN, TP → Increase in Concentration of TN, TP → Algal Bloom (Red Tide, etc.) → Deterioration of Transparency → DO Decrease (Cause of Anoxic Water Mass, Blue Tide, etc.) → Degradation of Sediment → COD Increase

Inflow of Organic Pollutant → Increase in Organic Pollutant

Fish Species Changes
Fishing Ground Changes
Fishes Decease
Malodor

Discharge from Industry, Household → Inflow of Organic Pollutant → COD Increase

Inflow of Organic Pollutant → Increase in Organic Pollutant

Fish Species Changes
Fishing Ground Changes
Fishes Decease
Malodor

Discharge from Industry, Household → COD Increase

Obstruction to Marine Recreation
Deterioration of Coastal Landscape
## Two Types of Effluent Control Measures

<table>
<thead>
<tr>
<th></th>
<th>Effluent Concentration Control</th>
<th>Total Pollutant Load Control</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objective of Regulation</strong></td>
<td>To prevent adverse effect caused by water pollutant near the discharge point.</td>
<td>To control water quality of the enclosed water that is end point of waste water.</td>
</tr>
<tr>
<td><strong>Target Substance</strong></td>
<td>All pollutants including hazardous substances for human health like heavy metals, VOCs, etc.</td>
<td>Mainly causative substances of eutrophication</td>
</tr>
<tr>
<td><strong>Pros</strong></td>
<td>Easy to implement to control the point sources.</td>
<td>Combination of adequate measures for each sites’ situation.</td>
</tr>
<tr>
<td><strong>Cons</strong></td>
<td>There is a case that this measure is not suitable for country situation.</td>
<td>More effort is necessary to monitor both the quality and quantity of effluent.</td>
</tr>
</tbody>
</table>
Standards of Regulation

Maximum Allowable Loading = Concentration × Volume of specified effluent (for specified facilities that’s daily volume of effluent is more than 50m³)

Reduction Guidance

Guidance for small size and unregulated facilities.
Guidance for agriculture and livestock industry

Project Execution

Maintain the Sewarage and Johkaso system.
Sophistication project of Sewage Treatment.
Countermeasures for degraded sediments.

Total Pollutant Load Reduction Plan (the Prefectural Governor)

Reduction method and amount for each sources; households, industrial and others.

TPLCS Policy (Minister of the Environment)

Basic matters regarding to reduction schedule, reduction amount, etc.

Water Pollution Control Law Article 4.2
Minister’s agreement with an advise of Conference on Environmental Pollution Control

Hearing to the Prefectural Governors
Consult to Conference on Environmental Pollution Control

Scheme of Total Pollutant Load Control System
TPLC Plan of Japan (1)

◆ Water Quality Goal

Achievement of EQS of $\text{COD}_{\text{Mn}}$ (1979-)
Achievement of EQSs of T-N, T-P (1992-)

◆ Target Year Every 5 years
### Target Amount of Pollutant Reduction

<table>
<thead>
<tr>
<th></th>
<th>CODMn</th>
<th>T-N</th>
<th>T-P</th>
<th>CODMn</th>
<th>T-N</th>
<th>T-P</th>
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<tr>
<td>Household</td>
<td>128</td>
<td>130</td>
<td>9.5</td>
<td>144</td>
<td>136</td>
<td>10.4</td>
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<td>Industry</td>
<td>41</td>
<td>29</td>
<td>1.7</td>
<td>42</td>
<td>29</td>
<td>1.8</td>
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<tr>
<td>Others</td>
<td>24</td>
<td>40</td>
<td>2.7</td>
<td>25</td>
<td>43</td>
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<td><strong>Total</strong></td>
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<td>199</td>
<td>13.9</td>
<td>211</td>
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<tr>
<td>Household</td>
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<td>50</td>
<td>4.4</td>
<td>99</td>
<td>52</td>
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<tr>
<td>Industry</td>
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<td>24</td>
<td>2.8</td>
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<td>26</td>
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<tr>
<td>Others</td>
<td>20</td>
<td>49</td>
<td>2.4</td>
<td>22</td>
<td>51</td>
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<td><strong>Total</strong></td>
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<td>123</td>
<td>9.6</td>
<td>186</td>
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<td><strong>Seto I.S.</strong></td>
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<td>Household</td>
<td>237</td>
<td>152</td>
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<td>Others</td>
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<td><strong>Total</strong></td>
<td>537</td>
<td>465</td>
<td>29.5</td>
<td>561</td>
<td>476</td>
<td>30.6</td>
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*Reference (value as 2004)*

**TPLC Plan of Japan (2)**

- Target Amount of Reduction
Methods of Pollutant Reduction

+ Promote the implementation of various waste water treatment facilities/equipments.
+ Ensure the compliance of the regulated point sources with standard of total pollutant load.
+ Develop the waste water guidance for unregulated small-scale facilities, agriculture, the livestock waste and feedings.
+ Promote the dissemination and the communication on the TPLCS.
+ Reinforce the self-purification capability of water by constructing artificial flat, etc.
Coverage Rate of Sewerage System in Japan

<table>
<thead>
<tr>
<th>Year</th>
<th>Coverage Rate (%)</th>
<th>Coverage (x10000)</th>
<th>Total Population (x10000)</th>
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<tbody>
<tr>
<td>1960</td>
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<td>2005</td>
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</tbody>
</table>

Effluent Control (1971)
TPLC (1980)
Change of Investment Cost for Pollution Control Equipment

Record of Investment cost for Anti-pollution of Private Company (Manufacturing)

A hundred million yen

Effluent Control (1971)

TPLC (1980)
Pollutant Load (T-N)

Remarks: ‘14 values = Target Amount

- others
- Industrial Discharges
- Household Discharges

Seto Inland Sea

Tokyo Bay

Ise Bay

TPLCS (T-N) put into practice in 2001
Pollutant Load (T-P)

Remarks: '14 values = Target Amount

- Others
- Industrial Discharges
- Household Discharges

TPLCS(T-P) put into practice in 2001
Transition of population, industry and pollutant load after starting the TPLCS (Ise Bay)
Transition of population, industry and pollutant load after starting the TPLCS (Tokyo Bay)
Transition of population, industry and pollutant load after starting the TPLCS (Seto Inland Sea)
T-N Distribution (Tokyo Bay)

T-P Distribution (Tokyo Bay)

Concentration of Chlorophyll-a at East Asia in 2004

(©JAXA)
### Japan-China Joint research on the TPLC (N, P)

#### Japan’s Experience
- More over 30 year TPLC (COD)
- From 2001, TPLC (N,P) started
- Developed Guidance for Implementing the TPLCS
- Provide information about laws, history and know-how
- Capacity Building for China’s administration official

#### China’s Experience
- Execution TPLC(COD) from Eleventh Five-Year (2006~)
- Research on Japan TPLCS
- Study on problems and enforcement policy on the TPLCS (N,P)
- Feasibility Study in model water area

#### Joint Research
- Reporting on the Japan–China Joint research on the TPLCS

#### China
- Execution TPLC(N,P) from Twelfth Five-Year Plans (2011~)

#### Improvement of eutrophication for target water area
Input of the change of discharge load (Seto Inland Sea)
Reproduction using the simulation

Change of Bottom sediment COD distribution

(The National Institute for Land and Infrastructure Management (NILIM), 2002)

Change of Bottom sediment COD distribution (measured value : mg/g)

Change of Bottom sediment COD distribution (simulation value : mg/g)
Simulation output (Tokyo Bay)

- **COD$\text{Mn}$**
  - 2004
  - 2034
  - 75% value (mg/L)
    - 0.0 ~ 1.0
    - 1.0 ~ 1.5
    - 1.5 ~ 2.0
    - 2.0 ~ 2.5
    - 2.5 ~ 3.0
    - 3.0 ~ 4.0
    - 4.0 ~ 6.0
    - 6.0 ~ 8.0
    - > 8.0

- **T-N**
  - 2004
  - 2034
  - Yearly average value (mg/L)
    - 0.0 ~ 0.2
    - 0.2 ~ 0.3
    - 0.3 ~ 0.4
    - 0.4 ~ 0.6
    - 0.6 ~ 0.8
    - 0.8 ~ 1.0
    - > 1.0

- **T-P**
  - 2004
  - 2034
  - Yearly average value (mg/L)
    - 0.00 ~ 0.02
    - 0.02 ~ 0.03
    - 0.03 ~ 0.04
    - 0.04 ~ 0.05
    - 0.05 ~ 0.06
    - 0.06 ~ 0.09
    - > 0.00
Simulation output (Tokyo Bay)

【Bottom layer DO】

2004 2034

【Transparency】

2004 2034
Simulation output (Ise Bay)

【COD<sub>Mn</sub>】

<table>
<thead>
<tr>
<th>Year</th>
<th>2004</th>
<th>2034</th>
</tr>
</thead>
</table>

75% value (mg/L)
- 0.0 ~ 1.0
- 1.0 ~ 1.5
- 1.5 ~ 2.0
- 2.0 ~ 2.5
- 2.5 ~ 3.0
- 3.0 ~ 4.0
- 4.0 ~ 6.0
- 6.0 ~ 8.0
- > 8.0

【T-N】

<table>
<thead>
<tr>
<th>Year</th>
<th>2004</th>
<th>2034</th>
</tr>
</thead>
</table>

Yearly average value (mg/L)
- 0.0 ~ 0.2
- 0.2 ~ 0.3
- 0.3 ~ 0.4
- 0.4 ~ 0.6
- 0.6 ~ 0.8
- 0.8 ~ 1.0
- > 1.0

【T-P】

<table>
<thead>
<tr>
<th>Year</th>
<th>2004</th>
<th>2034</th>
</tr>
</thead>
</table>

Yearly average value (mg/L)
- 0.00 ~ 0.02
- 0.02 ~ 0.03
- 0.03 ~ 0.04
- 0.04 ~ 0.05
- 0.05 ~ 0.06
- 0.06 ~ 0.09
- > 0.09
Simulation output (Ise Bay)

【Bottom layer DO】

2004

2034

Yearly minimum value (mg/L)

0.0 ~ 0.5
0.5 ~ 1.0
1.0 ~ 1.5
1.5 ~ 2.0
2.0 ~ 2.5
2.5 ~ 3.0
3.0 ~ 3.5
3.5 ~ 4.0
4.0 ~ 5.0
> 5.0

【Transparency】

2004

2034

Yearly average value (m)

0 ~ 1
1 ~ 2
2 ~ 3
3 ~ 4
4 ~ 5
5 ~ 6
6 ~ 7
7 ~ 8
8 ~ 9
> 9
Simulation output (Seto Inland Sea)

【COD₇₅₅₉】

2004  |  2034

【T-N】

2004  |  2034

【T-P】

2004  |  2034

75% value (mg/L)
- 0.0 ~ 1.0
- 1.0 ~ 1.5
- 1.5 ~ 2.0
- 2.0 ~ 2.5
- 2.5 ~ 3.0
- 3.0 ~ 4.0
- 4.0 ~ 5.0
- 5.0 ~ 6.0
- 6.0 ~ 7.0
- > 7.0

Yearly average value (mg/L)
- 0.0 ~ 0.2
- 0.2 ~ 0.3
- 0.3 ~ 0.4
- 0.4 ~ 0.5
- 0.5 ~ 0.6
- 0.6 ~ 0.7
- 0.7 ~ 0.8
- 0.8 ~ 0.9
- 0.9 ~ 1.0
- > 1.0

Yearly average value (mg/L)
- 0.00 ~ 0.02
- 0.02 ~ 0.03
- 0.03 ~ 0.04
- 0.04 ~ 0.05
- 0.05 ~ 0.06
- 0.06 ~ 0.08
- 0.08 ~ 0.09
- > 0.09
Simulation output (Seto Inland Sea)

【Bottom layer DO】

2004 2034

【Transparency】

2004 2034

Yearly minimum value (mg/L)
- 0.0 ~ 0.5
- 0.5 ~ 1.0
- 1.0 ~ 1.5
- 1.5 ~ 2.0
- 2.0 ~ 2.5
- 2.5 ~ 3.0
- 3.0 ~ 3.5
- 3.5 ~ 4.0
- 4.0 ~ 5.0
- > 5.0

Yearly average value (m)
- 0 ~ 1
- 1 ~ 2
- 2 ~ 3
- 3 ~ 4
- 4 ~ 5
- 5 ~ 6
- 6 ~ 7
- 7 ~ 8
- 8 ~ 9
- > 9