Policy to Practice - A Case Study on the Cooperation on Water Quality Monitoring in the Lower Mekong River Basin

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Abstract: In response to concerns of its Member Countries on potential water pollution and its implication, the Mekong River Commission established a network for water quality monitoring that covers 39 stations across the Lower Mekong Basin. Since then, the cooperation on water quality monitoring in the Lower Mekong Basin has strengthened, paving the way for the collaborative development and adoption of the Procedures for Water Quality and its Technical Guidelines. Since their adoption, these policy measures have been used as decision support tools for the management of water quality of the Mekong River, and have resulted in the adoption of regional water quality guidelines and assessment tools, including water quality indices for the different uses – the protection of human health, the protection of aquatic life, and agricultural use. This case study illustrates how policy can play an important role in promoting regional cooperation on water quality monitoring and management. It will focus on how policy measures adopted by the MRC Member Countries have enhanced their capacities to manage the Mekong River water quality.

Keywords: Water quality monitoring, The Mekong River Commission, The Procedures for Water Quality.

1. Introduction

The cooperation on water quality monitoring in the Lower Mekong Basin dates back to the early 1980s when the Interim Committee for Coordination of Investigations of the Lower Mekong Basin, the predecessor of the Mekong River Commission (MRC) Secretariat, initiated an investigation on the availability of the water quality information within the Lower Mekong Basin. The results of the investigation called for the Lower Mekong Countries (Cambodia, Lao PDR, Thailand and Viet Nam) to strengthen their cooperation on water quality monitoring. As such, the MRC Water Quality Monitoring Network (WQMN) was established in 1985 with the main goals of (i) providing timely data and information on the status of water quality; (ii) facilitating the identification of change in water quality; (iii) providing data that can be used by stakeholders for assessing and identifying potential impacts of developments; and (iv) providing uniform guidelines on water quality monitoring.

Since its establishment, the WQMN has provided a continuous record of water quality data to support the management of the water resources of the Mekong River. At the peak of monitoring, as many as 90 stationed were samples across the Lower Mekong Basin. Since 2008, the MRC Member Countries have collaboratively monitored water quality at 48 stations on a monthly basis, covering 18 parameters.

2. Policy Measures for Strengthening Cooperation on Water Quality Monitoring

Reconfirming their commitment to cooperate in a constructive and mutually beneficial manner to utilize the waters of the Mekong River Basin, and realizing that sustainable development of the water resources of the basin will not be possible without effective management of water quality, the MRC member Countries adopted the Procedures for Water Quality (PWQ), which has the main objective of maintaining acceptable/good water quality to promote sustainable development of the Mekong River Basin. With the adoption of the PWQ, the MRC Member Countries have collaboratively developed technical guidelines to support its implementation, including the Technical Guidelines for the Protection of Human Health (TGH) and the Technical Guidelines for the Protection of Aquatic Life (TGA). These two technical guidelines have been developed as decision support tools for the management of water quality in the Lower Mekong Basin. They define water quality criteria, outline requirements for water quality monitoring, and provide information on how to assess the suitability of the quality of water for the protection of human health and aquatic life.

For the TGH, the target values are the highest acceptable values in the Water Quality Standard for domestic use of the Member Countries, and they are classified into Direct (Table 1) and Indirect Impact Parameters (Table 2).

Table 1: Criteria and Target Values for the Protection of Human Health (Direct Impact Parameters)

No	Parameters	Symbol	Unit	Value	Analytical method[1]
1	Total Arsenic	Total As	mg/l	0.01	3550-As/SM
2	Cadmium	Cd	mg/l	0.005	3110-Cd/SM
3	Chromium Hexavalent	Cr	mg/l	0.05	3550-Cr/SM
4	Cyanide	CN	mg/l	0.01	4500-CN/SM
5	Lead	Pb	mg/l	0.05	3110-Pb/SM
6	Total Mercury	Total Hg	mg/l	0.002	3112-Hg/SM
7	Phenol	C_6H_5OH	mg/l	0.005	5530-Phenol/SM
8	Total Organochlorine Pesticide		mg/l	0.05	6630-organochlorinePesticides/SM
9	Faecal Coliforms		MPN/100 ml	1000	9230-Ecoli Group/SM

Table 2: Criteria and Target Value for the Protection of Human Health (Indirect Impact Parameters or Environmental Stressor Parameters)

No	Parameters	Symbol	Unit	Value	Analytical Method[1]
1	Ammonia as N	NH_3 as N	mg/l	0.5[2]	4500-NH_3/SM
2	Biological oxygen demand	BOD_5	mg/l	4	5210-BOD_5/SM
3	Conductivity	EC	mS/m	70-150	2510-Ec/SM
4	Dissolved Oxygen	DO	mg/l	≥ **6**	4500-O/SM
5	Total Nitrite and Nitrate as N	$(NO_2 + NO_3)$ as N	mg/l	5	4500-NO_3/SM
6	pH	pH		6-9	4500-H /SM
7	Temperature	T	^oC	Natural	2550-Temp/SM
8	Total Coliform		MPN/100ml	5000	9221-Coliform group/SM

For the TGA, the target values are the acceptable values in the Water Quality Standards for protection of aquatic life of the Member Countries and values from fresh water guidelines of countries with similar natural conditions as the Mekong River.

Table 3: Criteria and Target Values for the Protection of Aquatic life (Direct Impact Parameters)

No	Parameters	Symbol	Unit	Value	Analytical method[1]
1	Arsenic	Total As	mg/l	0.01	3550-As/SM
2	Cadmium	Cd	mg/l	0.005	3110-Cd/SM
3	Chromium Hexavelent	Cr (VI)	mg/l	0.05	3550-Cr/SM
4	Copper	Cu	Mg/l	0.1	
5	Cyanide	CN	mg/l	0.005	4500-CN/SM
6	Lead	Pb	mg/l	0.05	3110-Pb/SM
7	Total Mercury	Total Hg	mg/l	0.001	3112-Hg/SM
8	Phenol	C_2H_2OH	mg/l	0.005	5530-Phenol/SM
9	Total Organochlorine Pesticide		mg/l	0.05	6630-organochlorinePesticides/SM
10	Ammonia	NH_3 as N	mg/l	0.2	4500-NH_3/SM
11	Biological oxygen demand	BOD_5	mg/l	3	5210-BOD_5/SM
12	Dissolved Oxygen	DO	mg/l	> 5	4500-O/SM
13	pH	pH		6-9	4500-H^+/SM
14	Temperature		°C	Natural	2550-Temp/SM
15	Nitrite[9]	NO_2 as N			
16	Nitrate	NO_3 as N	mg/l	5	4500-NO_3-C/SM
17	Phosphate	PO_4 as P			

Aside from setting criteria and target values, the TGH and TGA also set out guidelines for the selection of sampling points, taking into account the following factors:

Representative areas along the Mekong River where people use, are exposed to and in contact with water from the mainstream Mekong River e.g. riparian settlements.

Cover a broad geographical range- representative of a wide range of freshwater riverine ecosystems.

Close to any possible sources of pollution such as effluent from factories, mines, and intense farming areas, and sewage outfalls.

At sites where there is a hydraulic change due to a dam, or a confluence with tributaries or rivers.

At transboundary positions to check the quality of the water entering and leaving the country.

3. Benefits of the Procedures for Water Quality and its Technical Guidelines

Rating Score	Class		
Protection of Human Health			
95 ≤ WQI ≤100	A: Excellent Quality		
80 ≤ WQI < 94	B: Good Quality		
65 ≤ WQI < 79	C: Moderate Quality		
45 ≤ WQI < 64	D: Poor Quality		
WQI < 45	E: Very Poor Quality		
Protection of Aquatic Life			
9.5 ≤ WQI ≤10	A: High Quality		
8 ≤ WQI < 9.5	B: Good Quality		
6.5 ≤ WQI < 8	C: Moderate Quality		
4.5 ≤ WQI < 6.5	D: Poor Quality		
WQI < 4.5	E: Very Poor Quality		
Agricultural Use			
		Degree of Consequence[1]	
Electrical Conductivity	Unit	A: None (Good)	B: Some (Fair)	C: Severe (Poor)
General Irrigation	mS/m	< 70	70 - 300	> 300
Paddy Rice Irrigation	mS/m	< 200	200 - 480	> 480

[1]None = 100% yield; Some = 50-90% yield; Severe = <50% yield

Table 4: Water Quality Classification Systems

The main objective of the PWQ is to establish a cooperative framework for the maintenance of acceptable/good water quality of the Mekong River to support sustainable development. With its adoption, the MRC Member Countries have agreed to cooperatively improve their capacities and methods for monitoring and assessing water quality. Specifically, the adoption of the PWQ has resulted in the collaborative development of:

Uniform methods and guidelines for the monitoring of the Mekong River water quality;

Expansion of the monitoring network, covering 48 primary stations (19 in Cambodia, 11 in Lao PDR, 8 in Thailand and 10 in Viet Nam);

Regional water quality criteria for the Protection of Human Health and for the Protection of Aquatic Life;

Cooperative framework for transboundary water quality emergency response and management;

Annual Lower Mekong Regional Water Quality Report and biennial Lower Mekong Report Card on Water Quality; and

The MRC Water Quality Indices to classify water quality based on difference uses (Table 4):

- The Protection of Human Health;
- The Protection of Aquatic Life (Table 5);
- and Agricultural Use.

Table 5: Water quality for the protection of Aquatic Life

4. Conclusions

The adoption of the PWQ illustrates commitment of the MRC Member Countries on the protection of water quality of the Mekong River, and has led to further collaboration on water quality monitoring and management. Its successful implementation has been attributed to its three main guiding principles – cost effectiveness, accountability, and transparency. Collaborative efforts for the implementation of the PWQ have resulted in the development of common tools and methods for water quality monitoring and assessment. More importantly, the PWQ will lead to sustainable water quality monitoring in the Lower Mekong River Basin.