Technical Advisory Paper No. 3

Future Needs in Water Quality Monitoring and Assessment

UNEP GEMS/Water Programme

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Future Needs in Water Quality Monitoring and Assessment

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The target audience for this paper is national focal points, collaborating focal points and partner agencies. Readers are encouraged to send comments, feedback and suggestions to info@gemswater.org.

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PART I: Introduction

The role of the Technical Advisory Group (TAG) is to convene every eighteen months to examine in detail a wide range of technical aspects of, and projects for, UN GEMS/Water Programme. The group is composed of members of the GEMS/Water Steering Committee, as well as representatives of other GEMS/Water partners. The TAG is chaired by a senior UNEP official.

Usually, the Technical Advisory Papers serve to provide background information as a guide for the discussions of the TAG meetings. The present paper is an exception, as it has been based on the recommendations and outcomes of the meeting. It still represents the "corporate view" of the TAG on global water quality monitoring, and the most salient issues facing GEMS/Water. It forms the basis for determining partnership activities: on one hand, the most constructive ways in which partner organizations can contribute to the successful implementation of core activities; and, on the other hand, the best ways for meeting partners' data and service needs.

This paper, being developed in that context, is divided into three main parts. Part I outlines the global context in which GEMS/Water works, and its roles.

For each of the four core activity area, there are several emerging issues identified for consideration by the TAG. The intent of Part II is to develop strategic recommendations to take advantage of opportunities, and to mitigate challenges. This section also focuses on key projects in which GEMS/Water is, or should be, actively engaged. The broader international scientific and technical context helps to identify the most constructive ways in which partner organizations can contribute to the successful implementation of the core activities. Part III introduces future needs in water quality monitoring and assessment and briefly addresses them. This paper will be used to guide the technical aspects of GEMS/Water for the near future.

Context— Core Activities and Results

1. Water Quality Advocacy, Assessment
Enhanced awareness of the state of water quality, importance of water quality monitoring, and problems and emerging issues through cooperation, among governments and the public, to better support sustainability.

A leading source of data, monitoring information, and analysis of inland water quality, for global and regional environmental **assessments and indicators** development for better understanding and decision-making of inland aquatic environmental issues related to global environmental change, and in support of MDG/WSSD targets.

2. Water Quality Data, Information
Development and maintenance of global water quality data and information systems to improve accessibility to credible and comparable data and, contribution to accessibility and interoperability with other environmental information systems.

GEMStat: global inland water quality **database** and information system, and GEMSoft support software.

3. Data Integrity, including Technical Tools, QA/QC, Alternate Technology
Increased reputation as a credible and reliable source for global water quality data and information, to add value to local-level data collection, and appropriate monitoring and observation technology.

Data Integrity (**QA/QC**) **tools** and resources, such as manuals and reference materials and an international laboratory performance evaluation system.

4. Capacity Building, Regional Development
Increased participation or involvement in water quality monitoring, assessment, research and reporting in developing countries and countries with economies in transition

Build the **capacity** of developing countries to collect, manage and analyze water quality information.

5. Organizational Performance Cross-cutting Function
Improved internal calibre of the Programme to deliver results 1 to 4 and products by strengthening human, financial and information management; and by institution building.

A cross-cutting function of measuring the achievement of the four other result areas through key **performance** indicators. This core activity was not addressed by the group.

Part II: Emerging Issues and Recommended Actions

1.0 Global Water Quality Assessments

- How can GEMS/Water best contribute to global and regional assessment results?
- What should GEMS/Water be anticipating in terms of future needs of assessment processes and governments?
- What is the correlation between scientific monitoring/assessment and the health of an ecosystem?

The Global State of Water Quality Monitoring:
The essential question for GEMS/Water is whether or not the water quality of lakes, reservoirs, rivers and ground waters throughout the world is improving or deteriorating. This question drives the role for GEMS/Water in data collection and assessment. This question should help guide GEMS/Water in providing services governments need to improve their capacity (as per the Bali Strategic Plan).

GEMS/Water annually reports on the global state of the GEMS/Water global monitoring network, alongside the Annual Report. The purpose is to create linkages within the network and to encourage participation and regional development.

The GEMS/Water global network now totals 2,743 stations, and the list of countries not participating is shrinking over time. The number of data points in GEMStat is now 2,323,026 and continues to grow.

Water Assessment Reports:
Linkages with the WHO/ UNICEF Joint Monitoring Programme would also be strategic, as focusing on water quality can contribute to the Millennium and WSSD goals. There are data on faecal coliform, for example, that demonstrate that the water and sanitation targets can be met.

Over the past year, GEMS/Water has contributed new data and assessments to the Global Environmental Outlook-4, the Global Biodiversity Outlook-2 and the World Water Development Report-2. Work is also underway on indicators, and developing a source drinking water index.

Forthcoming is a new and independent publication entitled *Water Quality for Ecosystem and Human Health*. This is the first report of its kind produced by GEMS/Water, and the target audience includes academia, research scientists, and water practitioners. Drawing on examples

from around the world, the report presents assessments of current status and trends in water quality. It also provides an introduction to a diverse range of issues of concern in global water quality, and approaches to their detection and resolution.

Indicators and Composite Index Development:
The 2005 Environmental Sustainability Index Report reported that:

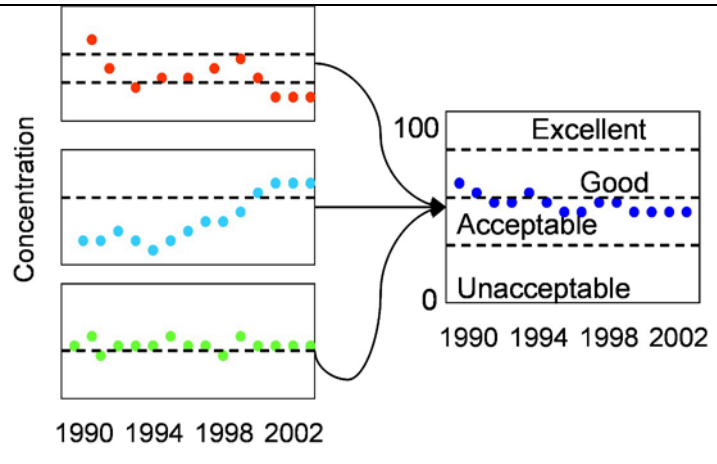
> The Global Environmental Monitoring System Water Program (GEMS/Water) has been an important source of data for the ESI because it is the primary source of comparable international information on surface water quality. The ESI reports were straightforward in their assessment that the suitability of the GEMS Water data for comparing water quality across nations was very low. In the past, very few countries provided data to the program and the data were difficult to obtain. When the 2003 World Water Development Report reprinted the 2002 ESI water quality indicator data, it drew attention to water quality data issues. Some governments were unhappy with the fact that the data table included only estimates of water quality where data was missing from GEMS/Water. Others were dissatisfied with the fact that some countries reported data from a large number of water monitoring stations whereas others reported only a small number. These complaints drew high-level attention to the serious deficiencies in the GEMS/Water program, and played a significant role in a strategic effort to build the program into a more robust repository of relevant water quality data. A major drive was launched to bring new countries into the program. The approach shifted from passively receiving data from countries to actively requesting data updates on a regular basis. In addition, the data was made much more easily accessible. As a result of these changes, participation in GEMS/Water has grown from less than 40 countries when the ESI first started using the data to over 100 countries today, although data coverage is still low. While the ESI cannot take credit for this shift, it did contribute to it by aggregating the GEMS Water data into national indicators and raising those indicators to high prominence.

GEMS/Water has become increasingly engaged in indicators development work within UNEP, and also with the WWAP and the Convention on Biological Diversity. Three water quality indicators are being developed:

- Source water quality indicator (SWQI);
- Biodiversity indicator – a GEF funded project, with UNEP-WCMC; and
- Eutrophication indicator.

Progress is also being made towards a Global Water Quality Index. The index calculation is based on important water quality variables compared to appropriate guidelines; results combined to produce a single number categorizing WQ as excellent, good, fair, marginal, poor.

$$\textit{WQ Index} = 100 - \frac{\sqrt{(F1^2 + F2^2 + F3^2)}}{1.732}$$



Where:
F1 = percentage of failed variables (scope)
F2 = percentage of failed tests (frequency)
F3 = amount by which failed tests exceed guidelines (magnitude)

UNESCO-IHP:
Participation between GEMS/Water and IHP continues to be very active, and a new MoU which was signed in July 2006. The main results from implementing the MoU are anticipated to:

- strengthen cooperation between UNESCO-IHP and GEMS/Water Programme, particularly with Ecohydrology and the International Sedimentation Initiative;
- maintain closer linkages with the World Water Assessment Programme as well as with Ecohydrology;
- increase the scientific aspects of the World Water Development Report in close cooperation with GEMS/Water Programme; and
- ensure collaboration with the new European Centre for Ecohydrology, Lodz, Poland.

Ecohydrology:
Also with UNESCO-IHP, GEMS/Water has strengthened its participation with the European Regional Centre for Ecohydrology. Very simply described, Ecohydrology is the rejection of extra nutrients, and reallocation of remaining nutrients (manipulating the water). Points of collaboration between IHP Ecohydrology and GEMS/Water focus on greater efficiency generated from investment in Ecoyhdrology for problem solving.

2.0 Global Water Quality Data

- How can divergent views on access to data be reconciled?
- How can GEMStat be expanded?
- How can data reporting become more efficient?

Access to Data:
It has been increasingly recognized that access to information and the sharing of tools and resources are vital to achieving results. Open access needs to be balanced with the wishes of data providers regarding use of their data. With these and other considerations in mind, GEMS/Water has expanded the global water quality online database, GEMStat, (www.gemstat.org), as an open web service. This action was launched on World Water Day, March 22nd 2006, at the World Water Forum IV in Mexico. A policy of open source has been equally applied to GEMSoft (forthcoming data submission software) to increase utility and interoperability.

GEMStat and Google Earth:
GEMStat monitoring stations are now mapped using Google Earth. This capability allows users to see the physical setting of every station, and its surroundings. With Google Earth all 2,743 GEMStat stations can be geospatially located with 3-dimentional satellite pictures. This means that the physical features and characteristics of each GEMStat monitoring station are visible, such as land use, deforestation, proximity to a factory or a city.

Since Google Earth is available free of charge, there are particular benefits to researchers and water quality managers in developing countries. Open standards are being promoted for this