UNEP GEMS/Water Regional Workshop

Water Quality Monitoring in Asia and the Pacific:

Challenges and Opportunities

REPORT OF THE WORKSHOP

5 - 8 November 2012
India Habitat Centre, Lodhi Road, New Delhi, India

The India Water Foundation and the UNEP GEMS/Water Programme

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Objectives

The objectives of the Regional Workshop on Water Quality in Asia & the Pacific were:

- To identify prevailing challenges at national and regional levels in water quality data acquisition and sharing, monitoring, assessment and reporting;
- To raise awareness about the GEMS/Water Programme, its network and database – increase participation in the Global Network and the submission of raw data to the GEMStat database;
- To determine the level of technical support, expertise and advice in water quality analysis to laboratories required in these countries;
- To reinforce collaboration with relevant water quality monitoring activities globally and regionally.

Expected outcomes

- Awareness of GEMS/Water network and database – better understanding of benefits and requirements;
- Identification of priority challenges and obstacles to acquiring and sharing national level water quality data, and options to overcome them;
- Identification of specific capacity building needs to improve water quality monitoring at national and transboundary levels;
- Renewed commitment from (participating) national water institutions to the GEMS/Water Programme and network;
- Increased communication and sharing of information and experiences amongst members of the network in the region and beyond;
- Agreement on next steps, viable actions, responsibilities and timelines.

Attendance

The workshop was attended by eight National Focal Points (NFPs), as well as representatives from regional and international organizations. Approximately 140 delegates from more than 40 organisations (national and international) attended the four days of workshop. The special session on India was attended by a large number of representatives from several Government of India ministries and organisations, such as the Ministry of Water Resources, the Ministry of Environment & Forests, the Ministry of Rural Development, the Ministry of Drinking Water & Sanitation, the Ministry of Earth Sciences, the Ministry of Agriculture, the Ministry of Urban Development, and the Ministry of Science & Technology. There were also representatives from provincial governments of Gujarat, Meghalaya Uttarakhand, West Bengal and Delhi (see Annex I for full List of Participants)

Organization of the Workshop

On the first day, 5th November 2012, an Inaugural function for the workshop was organised in the evening. On 6th November 2012, the second day, three panel discussion sessions were held. The first and second Panel Sessions were on different issues pertaining to GEMS/Water National and Collaborating Focal Points (NFPs and CFPs) in the Asia-Pacific region, and the third on International/Regional Organizations.

On the third day of the workshop, 7th November 2012, the programme was divided in two parallel sessions, one (in panel format) for the GEMS/Water NFPs and CFPs, regional and international organisations and another specifically to address water quality issues in India.

The GEMS/Water panels (two) were preceded by technical presentations given by a representative of the GEMS/Water team based in Canada. The discussions during the first panel session focused on water quality issues and challenges, capacity building for water quality monitoring and assessment, and the role of GEMS/Water Programme in facilitating those activities. Deliberations during the second panel related to application of water quality data and information to support decision-making and national and regional water quality monitoring programmes, and the role of the global water quality database, GEMStat.

The concurrent, special event on "Water Quality Monitoring in India: Challenges and Opportunities" brought together a large number of representatives from the Government of India, as well as from public and private NGOs, organizations, institutes and universities.

The fourth and last day of the workshop, 8th November 2012, was conducted in plenary, bringing together highlights, recommendations and conclusions from all deliberations and sessions. A list of actions was agreed at this session.

In the afternoon of the last day, there was a special session organised by the India Water Foundation on "Youth and Capacity Building in Water", which was attended by school children from New Delhi-National Capital Region (NCR). The pupils were invited to participate in group discussions and a painting competition.

The Programme of the workshop with all sessions is included in Annex II to this report.

Day 1 – Inaugural Session

The Inaugural session of the workshop was held on the evening of 5th November 2012. Dr Arvind Kumar, President of the India Water Foundation (IWF), delivered the welcome address. Dr. Norberto Fernandez, Manager of the GEMS/Water Programme also welcomed the guest and delegates.

The workshop was officially inaugurated by the Honorable Minister of Water Resources of India Mr Harish Rawat. Also present as Guests of Honour were the Union Minister of State for Rural Development, Mr Pradip Jain, the Secretary of Union Ministry of Urban Development, Mr Sudhir Krishna, the Secretary of Union Ministry of Drinking Water & Sanitation, Mr Pankaj Jain, the Chairman of the Indian Agricultural Research Institute (IARI), the Ministry of Agriculture, Mr H S Gupta and Mr. Y. P. S. Mohan, Chief Post Master General of Delhi Circle Ministry of IT and Communications.

Brief summaries of interventions are included in Annex III.

Day 2 – Presentations

The second day of the workshop was dedicated to presentations from the GEMS/Water National Focal Points, regional and international organizations operating the in the region, and discussions in panel format on several water quality issues and challenges raised by the participants.

To ensure the presentations would serve as a basis and provide support for subsequent discussions, the Secretariat circulated five questions in advance so that each presentation could address those issues and allow for the identification, comparison, and analysis of common challenges and issues in water quality monitoring in the various countries and within the region.

The questions were as follows:

a) What role does your institution/organisation play in water quality monitoring in the Asia-Pacific region? With what other institutions your organisation collaborates at regional and national levels?

b) What water quality parameters is your institution/ organisation gathering data about and what monitoring systems, if any, are in place (e.g. for freshwater ecosystems, drinking water, etc.)?

c) What does your institution/agency do with the data acquired? (Please provide a few relevant examples of their use and applications to illustrate how data are integrated into water resources plans and relevant decision-making processes).

d) What are the main challenges your institution/ organisation is facing to acquire water quality data and share the data with other organizations both at national and international levels?

Presentations from National Focal Points included Mongolia, Sri Lanka, India, Cambodia, People's Democratic Republic of Lao, New Zealand, Singapore and Vietnam. A summary of each presentation is provided in Annex V.

Outcomes of the presentations and discussions from the GEMS/Water National Focal Points

The participants' presentations identified a number of key challenges, which were further discussed on the following day. The issues, main challenges and problems identified by the representatives of the institutions were grouped as follows:

- **Data and Information Management:**
  - i. Encouraging of data communication and data exchange
  - ii. Need for uniform reporting of water quality data and assessments
  - iii. Need for data integration, data validation and data security
  - iv. Need for water quality data indices including the basis of their development
  - v. Need for acquiring data on Arsenic toxicity in ground water, which is recognized as a regional/national concern.
  - vi. Uniformity in analysis of parameters for reporting.
- **Sustainability of Monitoring System:**
  - i. For water quality management, the hydrological observation and water quality monitoring sites to be coterminous as for possible.
  - ii. Lack of manpower & financial resources
  - iii. Shortage of water quality monitoring and analytical equipments
  - iv. Fostering interagency coordination
- **Capacity Building at National level:**
  - i. General lack of regular water quality training for field and laboratory staff including Training of Trainers.
  - ii. Building capacity of application scientists towards water quality monitoring network optimization work.
- **Technology:**
  - i. Mapping and assessment of non-point source of pollution
  - ii. Need for international cooperation and assessment in modeling the fate of contaminants and pollution transport
  - iii. Need for optimization of water quality networks monitoring systems.
  - iv. Technology of desalinization of water and water pricing
  - v. Water pricing aspects
  - vi. Newer technology of water quality monitoring
  - vii. Enforcement of regulatory water quality monitoring mechanism in problem areas.
  - viii. Need for water quality bio-remedial technology

Objective of GEMS/Water:

i. Rendering advice on emerging water quality concern
ii. Rendering advice on cost effective methodology of desalination of water
iii. Arranging circulation of publication/stastical or water quality monitoring & assessment
iv. Rendering expert service on how transboundry water quality monitoring would increase cooperation
v. Render some technical help to monitoring non-point services of pollution.

Common Outcomes of the Panel Session for GEMS/Water National Focal Points and the Regional/International Organisations

The common outcomes of discussions and deliberations held in the Penal Sessions for NFPs and for Regional/ International Organisations are outlined below:

- Need for water quality indices along with the basis of their development
- Data on river sand mining and water pollution
- Need for water quality monitoring network optimization (common to all country needs)
- Data validation and data security
- Reduce environmental flaws in river water flows and related water quality problems
- Lack of regular water quality training for laboratory/field staff
- Lack of manpower / financial resources
- Methods of choice of sites for water quality sampling
- Regulatory water quality monitoring mechanisms by participating states and their enforcements
- Lack of inter agency coordination
- India/Singapore indicated help and cooperation for a regional Hub
- Shortage of analytical instruments for water quality monitoring
- Lack of data sharing with neighboring countries and the need to improve it
- Methodologies and information on of water desalination
- Discharge of untreated waste water polluting river and streams
- New water pricing
- Cost of water for large number of parametric determination
- Remote water quality monitoring systems
- Strengths of National Focal Points to local/regional services such as :
- Rendering of advice on emergency water quality concerns
- Analytical testing
- Lab certifications
- Help with best practices and lessons learnt for sharing of data

- Data sharing and harmonization
- Consistency in water quality monitoring and assessment
- Newer aspects of monitoring

Day 3 – Plenary Panel Discussions

Two Plenary sessions took place on the third day of the workshop to discuss, in panel format, the following themes:

Session 1 (morning): "Water quality issues and challenges – Capacity building for water quality monitoring and assessment - The role of the GEMS/Water Programme."

The purpose of the session was to identify the most pressing issues for regional and national capacity building in water quality monitoring, data analysis and information archiving and management; and, in this context, the role/niche for GEMS/Water in supporting that capacity building in the technical areas.

Session 2 (afternoon): "Applications of water quality data and information to support decision-making and national and regional water quality monitoring programmes - The role of the global water quality database GEMStat."

The purpose of the afternoon session was to encourage the submission of water quality monitoring data to GEMStat, the global water quality database, by highlighting the many benefits to be had by registered members of the network and by discussing applications of water (GEMS/Water) water quality data and information, the status of the GEMS/Water global network and database (GEMStat), and specifically their value to country and regional needs

To facilitate and focus group discussions the Secretariat distributed a series of guiding questions for each session, which were adapted to the context of the discussions (see Annex IV).

An important expected outcome of each discussion session was the identification of viable actions to be implemented in the short term by organizations and members of the GEMS/Water Programme to help overcome the challenges identified on the first day of the workshop.

Each session was preceded by a related technical presentation by the GEMS/Water Team based in Canada. For Session 1 the presentation was on "Ensuring Data Quality in the GEMS/Water Global Network", and for Session 2 on "GEMStat – the global water quality database". (see Agenda in Annex II).

Each technical presentation focused on two of the Programme's four core activities which are:

- Collection of water quality monitoring data;
- Ensuring the quality or reliability of the data in the database;
- Information sharing; and
- Capacity building activities.

The first presentation outlined activities related to data quality and capacity-building support to the GEMS/Water network, while the second described the collection of monitoring data and the sharing of water quality data and information with data users and decision-makers for assessments, publications, models, and index development.

The presentation in Session 1 detailed the QA/QC tools and other technical resources that are made available to participating countries in the GEMS/Water Programme to ensure the quality of their analytical measurements. These resources are designed to enhance the capacity of laboratories in the global network to generate high quality data and include guidance manuals, training courses, an Analytical Methods Dictionary, performance evaluation

(PE) studies, and evaluation services. These latter services range from on-site assessments of laboratory operations against international standards, such as ISO/IEC 17025, to comprehensive reviews of national or regional water quality monitoring programmes.

This first presentation also outlined the efforts undertaken by GEMS/Water staff to ensure the quality and integrity of data in GEMStat. These include procedures for scrutinizing the quality of incoming data from National and Collaborating Focal Points (NFPs/CFPs), using rigorous statistical analyses to verify the integrity and comparability of existing subsets of GEMStat data (by parameter, by station, and by country), and assuring the appropriate selection of extracted data used by decision-makers for input to regional and global assessment reports, to water quality and climate change models, and for the development and publication of water quality and biodiversity indices.

The second technical presentation focused on the global water quality database GEMStat, with particular emphasis on new on-line functionalities that facilitate the input of monitoring data, and tools developed to improve data and information sharing. A significant part of the presentation described the features of, and benefit to, using GEMStat and to becoming a registered user (member). As members, NFPs and CFPs can better manage their data, share data, format data for more efficient and timely input into GEMStat, analyze new and existing data, etc. They can also set the level of access to their raw data and can now check the fit of any new data within their existing GEMStat data set. Finally, examples of several enhanced on-line functionalities were provided including new statistical routines, graphing enhancements, Google Earth mapping, producing and downloading reports, and Web Services.

Outcomes of the plenary sessions

The main issues and challenges identified for both sessions, as well as potential actions to address them are summarized below:

- **Data and information Management:**
  - i. Training of technical staff to maintain databases, and security and integrity of systems.
  - ii. Adopting uniform data standards & protocols
  - iii. Homogeneity of data format enabling their compatibility, comparability & Exchange
  - iv. Training of national staff on the use of GEMStat statistical tools.
- **Sustainability of Water Quality Monitoring Systems:**
  - i. Proper operation and maintenance of monitoring systems from stability point of use
  - ii. Ensuring data integrity reliability of water quality monitoring and information system
  - iii. Locating funds for financing the monitoring systems
- **Capacity Building:**
  - i. Need for improving technical capacity of technicians, application scientists and engineers in the use of standardized methods and techniques of data collection, analysis and management including use of prediction models.
  - ii. Taking up of activities including exchange of experience leading to strengthening of water quality monitoring programme.

- **Technology:**
  i. Considering the use of installation of automatic water quality monitoring data loggers in water quality monitoring systems
  ii. Considering the use of satellite telemetry for water quality monitoring in un-attended & remote coverage areas.
  iii. Develop technological skills in the application of state of art pollution transport & ground water models.
- **Objectives of GEMS/Water and its presence at national and regional levels.**
  i. Using GEMS/Water information sources for developing applications and assessments of water quality.
  ii. Institutions/Countries may share experiences in statistical tools through the network.
  iii. Developing of regional/national information and data directories through collaboration.
  iv. Involving GEMS/Water in pilot projects on water quality remediation projects.

Day 3 – Concurrent Event on "Water Quality Monitoring in India: Challenges and Opportunities"

Parallel to the main sessions (Panel discussions in plenary), a special session for other stakeholders was held on Day 3, to discuss water quality monitoring at national and local levels in India.

This concurrent event provided a unique opportunity to bring together twelve ministries of Government of India, regional water authorities, non-governmental organisations (NGOs), private sector, universities and others, to discuss several aspects of water quality monitoring in the country.

Presentations and discussions were arranged around the following four technical themes:

a) Ground Water Quality Resources Monitoring & Assessment
b) River Water Quality Assessment and Relationship to River Basin Planning
c) Water Quality Monitoring Networks
d) Regulatory, Policy and Management Aspects of Water Quality Monitoring and Assessment

There was convergence of intentions, objectives and outcomes amongst the participants, so that, at the end, a plan of action was drawn to enhance cooperation between UNEP GEMS/Water with Indian organisations.

Thirteen presentations were given for the four themes. They were made by scientists from the Central Ground Water Board (CGWB), the Central Water Commission (CWC), the Ministry of Water Resources, the National Environmental Engineering Research Institute (CSIR-NEERI), the Delhi Jal Board (DJB), the National Institute of Hydrology (NIH, Roorkee), the Narmada Control Authority – Ministry of Water Resources, the Centre for Ground Water Studies (CGWS) of West Bengal, the Indian Institute of Technology (IIT), the Japan International Cooperation Agency (JICA) – India Office, the Action for Food Production (AFPRO), the Meghalaya Water Resources Development Agency (MWRDA), the Water Quality Assessment Authority (WQAA) – Ministry of Water Resources, and the Dunar Foods Ltd. (Haryana, India).

The topics delivered for each of the themes are detailed in Annex IV to this report.

Outcomes of the Session

Besides discussing the dimensions and concerns of the quality of surface and ground water resources, participants also delved into the needs for remediation technologies and research towards mitigation of problems of fluorosis and arsenocosis in groundwater, the increasing problem of eutrophication, presence of algae and trace metals in surface waters. The discussions also emphasized the need for strengthening laboratories with the state-of-art equipment and training of analysts, as well as the need for awareness programmes for rural and urban communities.

The purpose of the session was to discuss studies of water quality monitoring in India, the problem, issues and common water quality threats to surface and ground water. The focus was on water quality assessment of river basin in India. The role of water quality assessment authority (India) constituted in 2001 under environmental protection act 1986 to control water quality and water pollution was highlighted.

Outcomes:

The main challenges identified as well as some potential actions to address them are summarized below.

- **Data & Information Management:**
  - i. Considered the monitoring of ground water quality through the 15,640 country-wide network stations once a year in May for water quality testing and a yearly publication on data. Seven national level organizations are monitoring water quality in India. The Central Water Commission is monitoring water quality for 396 sites on river and mountain data on 186 base line, 182 trend and 28 impact stations.
  - ii. Need for data integration and water management intervention stressed.
  - iii. The use of data management tools available through GEMStat were emphasized
- **Sustainability of Monitoring System:**
  - i. Future developments in water quality data monitoring system were noted to have limitations of funds.
- **Capacity Building:**
  - i. Inadequacy of trained staff to manage, analyses, prepares and submits data to GEMStat was observed
  - ii. GEMStat to provide data information products needed by policy and decision makers.
  - iii. GEMS/Water should help national capacity building for generation of data bases.
- **Technology:**
  - i. GEMS/Water to facilitate data management information, standardization & data communication and use of latest technologies.
  - ii. Exchange of experience and expertise proposed.
  - iii. Particular emphasis should be given to pilot-projects through latest remediation technologies for arsenic and fluoride mitigation in problem areas.
- **Objectives of GEMS/Water and how to increase its presence at regional and National Level:**
  - i. Need to consider international arrangement to help member nations through remediation technologies for mitigation of fluoride, arsenic and nitrate contamination in through pilot projects.
  - ii. Guidelines and activities by GEMS/Water to be freely available on its website.

Day 4 –Conclusions and Recommendations of the Workshop

The last day of the workshop was dedicated to reviewing the issues and challenges discussed during the first days of the meeting, in order to identify and propose viable actions to be implemented in the short term by organizations and members of the GEMS/Water Programme and others, to respond to those challenges. A technical presentation by the IARI Ministry of Agriculture, Government of India was made at the end of the session (see Annex IVb)

The following is a list of agreed actions and conclusions of the workshop:

SUGGESTION	ACTION	RESPONSIBILITY	TIMELINE
1. Link Water Basin Authorities to GEMS/ Water Consider some criteria for selection: e.g. Basin Authorities must have water quality monitoring programmes/systems in place or mandates, progress; institutionally is well established, etc.	(a) Prepare List of watersheds/basins, including contacts (with inputs from ROAP and FPs) (b) Formalize linkages (MoA?, MoU?)	(a) GEMS-Nairobi to send request for info to NFPs and CFPs (b) NFPs/CFPs to send information to UNEP to compile final list (c) UNEP-DEWA to draft agreement(s)	(a) April 2013 (b) Responses by July/13 (c) Sept/Oct 2013
2. Be proactive in building relations with senior officials in contributing organizations.	(a) Newsletter sent to NFPs that they can pass on to senior managers, with cover letter recognizing value of data contributed. [Newsletters also require contributions from members – two-way].	- NFPs, CFPs, Basin Authorities, etc. to contribute articles and other info; - GEMS/Water to prepare and issue newsletters - G/W Manager (NF) to send letter to each NFP	- 1st Newsletter by March 2013; - 2nd Newsletter by Sept 2013
	(b) Update NFP Specifications document	GEMS/Water team to discuss with new host	On hold
3. (a) To assist and partner with NFPs to use/ disseminate statistical tools/GEMStat.	(a) Consider 'tailored coaching'; Webinars for training in specific topics – online training	GEMS/Water - Canada	- GEMStat User Guide on website by April 2013 - Provide Data Acquisition Instruction Manual to Registered Members by April 2013

SUGGESTION	ACTION	RESPONSIBILITY	TIMELINE
4. How to share experiences on technical issues through the GEMS/Water network?	Consider: • A discussion space, forum or "users group" on the gemswater website.	UNEP GEMS/Water & NFPs to agree on a host and facilitator	
	• "Ask an expert" feature in the website and e-Newsletter. [Identify experts in the region willing to present segments on water quality issues through the GEMS/Water site (see www.unep.org/gemswater/)	Focal Points to consult with their institutions about official participation, and decide areas of expertise. Follow up with GEMS/Water (NF)	- Focal Points to respond by May 2013 - UNEP staff to update website by May 2013
	• "Best practices" – Online forum for sharing experiences. [needs moderator]	India Water Foundation and GEMS/Water	
	• Compile list of protocols in use	GEMS/Water to initiate in collaboration with NIWA, PUB, Env.Canada	- Provide links and/or guidance documents on gemswater website for: e.g. Sampling Protocols/ Methods (on-going)
5. Data gaps: what gaps exist and how to fill them?	GEMS/Water Canada to identify gaps and communicate to NFPs. Members to review their data records and try to fill gaps.	• GEMS/Water Canada Office • NFP representatives to provide response (i.e. propose/decline plan of action)	- Country summaries to NFPs by April 2013 - NFP response by May 2013 (i.e. identify whether additional data will be submitted)
6. Identification of (sub) regional institution(s) to serve as potential "hubs".	UNEP GEMS/Water to consult with institutions (also as part of the business model implementation)	• GEMS/Water (Nairobi) and India (IWF + Ministries) • GEMS/Water and NIWA	
7. (a) Translation of relevant documents/ courses to English and other languages to increase access to and dissemination of information.	Collaboration between CAREC and GEMS/Water for translation of relevant projects to be placed on GEMS/Water website – might involve Russian NFP (to be consulted)	CAREC with GEMS/Water team	

SUGGESTION	ACTION	RESPONSIBILITY	TIMELINE
(b) CAREC requested GEMS/ Water website to be available in Russian.	Collaboration between CAREC and GEMS/Water to translate web content and to produce Russian web pages on www.unep.org/gemswater	- CAREC with GEMS/ Water - UNEP-Nairobi to upload translated content and links	- Russian web pages to go live by June/July 2013
8. Guidelines and standards for water quality in freshwater ecosystems.	Information – keep regional network informed on developments under UN Water Group on this	NF	April 2013
9. Global Water Quality Assessment Report Project	Information – keep regional network informed on developments under UNEP and UN Water Group on this	NF	April 2013
10. Training	(a) NFPs to notify GEMS/ Water of training needs (b) GEMS/Water to identify training modules to be updated & identify universities/institutions to produce updated courses	(a) UNEP- Nairobi to issue email requesting information (b) GEMS-Nairobi (NF) in consultation with SACEP, Water Technology Centre (Indian Agricultural Research Institute, PUB Water Hub, NIWA, CAREC	- email to NFPs in April 2013 in conjunction with Action 1a - responses from NFPs by May - UNEP to summarize common/ priority training needs by June/ July

Afternoon of Day 4 – Outreach Side Event: "Youth and Capacity Building in Water Quality Monitoring in India"

An outreach side event organized by the India Water Foundation took place in the afternoon of the last day of the workshop to mark the end of the event. The purpose of the event was to promote water issues and to motivate the involvement of the youth in environmental water activities. The event, which was attended by school children from selected schools in New Delhi, was divided in two parts, one dealt with group discussion on water related issues, and the other was devoted to Painting Competition on water themes. Prizes were given to the winners of the contest, and Certificate of Appreciation were awarded to all participating students. The India Department of Posts gave a presentation emphasizing the importance of water conservation and how the Department of Posts is implementing a (rooftop) rainwater harvesting mechanism in spacious postal buildings. The event was very well attended by students and teachers, who gave an enthusiastic response to the call of the India Water Foundation. (Details of the event and presentation are in Annex V)

Annex I – List of Participants

Inaugural Session – Participants to the Podium

- Mr. Harish Rawat — Union Minister of Water Resources of India
- Mr. Pradeep Jain — Union Minister of State for Rural Development of India
- Mr. Sudhir Krishna — Secretary of Union Ministry of Urban Development of India
- Mr. Pankaj Jain — Secretary of Union Ministry of Drinking Water & Sanitation of India
- Dr. H S Gupta — Chairman of the Indian Agricultural Research Institute (IARI), Ministry Agriculture of India
- Mr. Y P S Mohan — Chief Post Master General Delhi Circle Department of Post, Ministry of IT & Communication of India
- Dr. Arvind Kumar — President of the India Water Foundation
- Dr. R Norberto Fernandez — Manager of the GEMS/Water Programme, United Nations Environment Programme (UNEP)

GEMS/Water National Focal Points (NFPs)

- Ms. Yadamsuren Erdenebayar — Mongolia
- Ms. T W A Wasantha Wijesinghe — Sri Lanka
- Ms. Nhim Sophea — Cambodia
- Ms. Phayvanh Bandavon — Lao PDR
- Mr.. Bui Nam Sach — Vietnam
- Dr. Richard Storey — New Zealand
- Mr.. Woo Chee Hoe — Singapore
- Mr. R M Bhardwaj — India

Regional and International Organizations

- Mr. W. K.Rathnadeera — SACEP
- Ms. GuljamalJumamuratova — CAREC
- Mr. Kongmeng Ly — Mekong River Commission (MRC)
- Eng. Avinash Chand Tyagi — Secretary General ICID
- Mr. Bharat R Sharma — Principal Researcher & Head of IWMI

United Nations Environment Programme (UNEP)

- Dr. R. Norberto Fernandez — Manager of the GEMS/Water Programme
- Mr. Patrick L Mmayi — UNEP GEMS/Water Programme
- Ms. Yvonne Stokker — GEMS/Water Programme, Environment Canada Office
- Mr. Zhang Jinhua — UNEP Regional Office for Asia and the Pacific
- Mr. Jaeyoon Park — UNEP Regional Office for Asia and the Pacific

India Water Foundation (IWF)

- Dr. Arvind Kumar — President
- Ms. ShwetaTyagi — Executive Secretary
- Dr. Suraj Sharma — Senior Advisor

Concurrent Event on "Water Quality Monitoring in India"

Presenters

- Mr. Mahendra Pal Singh — Addl. Chief Development Specialist JICA, India
- Dr. Ashok K Keshari — Professor IIT Delhi, India
- Mr. J K Bassin — Deputy Director & Head NEERI Ministry of Science & Technology, India
- Dr. Sudhir Srivastava — Scientist CGWB, MOWR, India
- Mr. C K Jain Scientist, — NIH Roorkee, India
- Dr. S P Sinha Ray — President Centre For Ground Water Studies (CGWS) West Bengal, India
- Mr. Sanjeev Agarwal — Chief Engineer Central Water Commission, India
- Mr. R S Tyagi — Chief Engineer Delhi Jal Board
- Dr. Afroz Ahmad — Director Narmada Control Authority MOWR of India
- Mr. W Kharkrang — Environmental Engineer, Meghalaya State Pollution Control Board (MSPCB)
- Mr. Khaja Mohiddin Syed, — Scientist 'C' Water Quality Assessment Authority MOWR GOI
- Mr. Rajib Kr. Roul — Programme Coordinator (AFPRO)
- Mr. Mohd. Mazhar Uddin — Dunar Foods Ltd.

Attendees

Mr. H K Varma	Sr. Project Officer ADB
Mr. Chihiro Fukuda	Representative JICA
Mr. N Jyoti Kumar	Sr. Scientist CGWB
Dr. Rajiv Kumar Gupta	Principal Secretary (Water Supply) Government of Gujarat,
Mr. D Mathur	Farelabs Food Analysis and Research Laboratory
Ms. Sonali Mittra	Junior Fellow Observer Research Foundation
Mr. Punit Srivastava	Manager Technical WaterAID (UK)
Mr. Youdhvir Singh	PHD Chamber of Commerce & Industry
Ms. Virginia Loyola	Business Events Sydney
Mr. S K Sinha	Scientist 'D' CGWB MOWR
Mr. Arun Kumar	Regional Director Central Ground Water Authority
Mr. S K Gupta	Sr. Manager HPCL
Mr. R C Sharma	Former Scientist 'D' CGWB
Mr. Satish Mantola	Former Executive Engineer MOWR GOI
Mr. I L Bhatia	Former Director Admin Ministry of Water Resources GOI
Ms. Valerie	GIS Specialist AFPRO
Mr. Nathaniel Dakar	Research Associate TERI
Ms. Shresth Tayal	Fellow TERI
Ms. KirtiDua	Executive Director DUNAR Foods Ltd.
Mr. Ravinder Singh	Director Water Quality, Water Quality Assessment Authority MOWR GOI
Mr. Shiv Harit	Editor –in- Chief SAR Economist
Mr. Dinesh Agarwal	CEO India Water Foundation
Mrs. Suneeta Trivedi	Member Planning India Post,
Dr. Ajit Tyagi	Koteswaram Professor and Permanent Representative of India with WMO Ministry of Earth Sciences GOI,
Mr. S K Mishra	Chairman INTO (Padma Bhushan)
Dr. Kulwant Singh	Regional Advisor UN-Habitat,
Dr. Rajiv Kumar Gupta	Principal Secretary (Water Supply) Government of Gujarat,
Mr. Brijesh Sikka	Advisor National River Conservation Directorate Ministry of Environment & Forest GOI
Dr. N Varadaraj	Member Central Ground Water Board MOWR GOI,
Mr. Arun Kumar	Regional Director Central Ground Water Authority MOWR
Mr. Hajime Hirosawa	First Secretary Embassy of Japan ,
Mr. A K Bajaj	Ex. Chairman Central Water Commission and Ex. Officio Secretary to the GOI Ministry of Water Resources
Mr. R M Bhardwaj	Senior Scientist Central Pollution Control Board (CPCB), Ministry of Environment & Forest GOI

Dr. ArijitDey	OSD to Minister of Water Resources GOI
Dr. Dinesh K Tyagi	M.D SREI Infrastructure Finance Ltd.
Mr. Sanjay Bajpai	Director/Sc-F, Department of Science & Technology, Ministry of Science & Technology
Mr. V Radhakrishna Murthy	Dy. General Manager Corporate Strategy & Planning, HPCL
Dr. M M Kimothi	Director Uttarakhand Space Application Centre, Department of Science & technology Govt. of Uttarakhand
Dr. Ram Boojh	Programme Specialist Ecological and Earth Sciences, UNESCO
Mr. Harish Kumar Varma	Senior Project officer Natural; Resources and Agriculture, Asian Development Bank
Mr. S K Sinha	Scientist 'D' (Sr. Hydrologist) CGWB GOI
Mr. Onkar Sharma	Secretary, IPH-Government of HP
Dr. Ravinder Kaur	Project Director Water Technology Centre IARI
Mr. Paritosh Tyagi	Former Chairman CPCB
Mr. K Kharkongor	Asst. GM Meghalaya Water Resources Development Agencies (MeWDA)
Mr. Ravinder Singh	Director Water Quality, Water Quality Assessment Authority MOWR GOI
Mr. Raja Ram Purohit	Scientist 'C' Water quality Assessment Authority MOWR Mr. Mahesh C Bhatnagar, Water Quality Assessment Authority MOWR GOI
Shri S C Dhiman	Former Chairman Central Ground Water Board (CGWB)
Dr. S K Sharma	Prl. Advisor IWF and Former Member CGWB
Shri A K Singh	P.S. to MOS (RD-PJ) Ministry of Rural Development
Shri Md. Sahid	P.S. to Hon. Minister of Water Resources
Mr. Ravinder Kumar	Executive Engineer India Post
Mr. Anil M Rokade	Deputy General Manager Canara Bank
Ms. Savita Agarwal	Renowned Painter
Mrs. Susmita Shekhar	Secretary General, PHD Chamber of Commerce &Industry
Mr. O P S Malik	Ex. DG Narcotics Control Bureau
Mr. H L Sangra	Former Director CGWB
Mr. R C Sharma	Former Scientist 'D' CGWB
Mr. Satish Mantola	Former Executive Engineer MOWR GOI
Mr. I L Bhatia	Former Director Admin Ministry of Water Resources GOI
Mr. R C Sharma	Consultant WAPCOS
Mr. S K Manaktala	Consultant WAPCOS
Mr. Rajiv Aggarwal	Chief Engineer Central Water Commission
Mr. S C Sharma	Under Secretary Department of Drinking Water & Sanitation
Mr. Sanjeev Agarwal	Chief Engineer Central Water Commission
Mr. Ramesh Jhamtani	Chief Consultant IWF and Former Advisor Planning Commission GOI
Mr. S. Sen	Principal Advisor Confederation of Indian Industry (CII)

Annex II – Agenda of the Workshop

Day 1	Monday, 5 November 2013	
Time (Hrs)	**Item**	**Chair**
17:00 –18:00	Registration [India Habitat Centre]	IWF
18:00 – 20:00	• **Official welcome and Opening Ceremony** [The opening ceremony will be led by a High Level Official from the Government of India - TBC.) • **Gala cocktail and dinner** (Organised and hosted by the Government of India and the India Water Foundation, at the India Habitat Centre) [The events will be also attended by various government officials, international representations, various stakeholders and the media.]	IWF

Day 2		Tuesday, 6 November 2012	
8:45	9:15	• Introductory remarks (IWF and UNEP GEMS/Water) • Adoption of the agenda • Introduction of participants • Objectives of the workshop, expected outcomes; organisation of work	
9:15	10:00	**Presentations on global/regional and host country water quality monitoring programmes and issues.**	
9:15	9:30	• **The India Water Foundation** – promoting water quality activities in India and the region [Dr. Arvind Kumar, President]	
9:30	10:00	• **UNEP GEMS/Water:** A Global Water Quality Monitoring and Assessment Programme [Dr. Norberto Fernandez, Manager UNEP GEMS/Water]	
10:00	10:30	*Coffee/tea Break*	
10:30	12:15	**1st PANEL SESSION – GEMS/Water National Focal Points**	
		Introductions and work format • Eng. (Ms.) Yadamsuren Erdenebayar, Central Laboratory of Environment and Meteorology. **MONGOLIA** • Mrs. T W A Wasantha Wijesinghe, Deputy Director, Central Environmental Authority, Ministry of Environment & Natural Resources. **SRI LANKA** • Mr J S Kamyotra, Member Secretary, Pollution Assessment Division, Central Pollution Control Board (CPCB) – Ministry of Environment & Forests. **INDIA** • Ms. Nhim Sophea, Director, Water Quality Analysis Office, Department of Hydrology and River Works – Ministry of Water Resources and Meteorology. **CAMBODIA** 30 minutes round of Qs/As	
12:15	13:30	*Lunch*	

13:30	15:15	**2nd PANEL SESSION – GEMS/Water National Focal Points**	
		Introductions and work format • Ms. Phayvanh Bandavon, Chief of laboratory. Department of Irrigation - Water Quality Laboratory. **LAO PDR** • Dr. Richard Storey, National Institute of Water and Atmospheric Research, Water Resources Archive. **NEW ZEALAND** • Mr. Woo Chee Hoe, Water Quality Office. National Water Agency. **SINGAPORE** • Mr. Bui Nam Sach, Director, Institute for Water Resource Planning. **VIETNAM** 30 minutes round of Qs/As	
15:15	15:45	*Coffee/tea Break*	
15:45	18:00	**PANEL SESSION – Water Quality in Asia-Pacific and International/Regional Organisations**	
		Introductions and work format (7 min addresses by Panelists) • **ESCAP Sub-regional Office for South Asia** [Dr. Nagesh Kumar, Chief Economist and Director] • **SACEP – South Asia Cooperative Environment Programme** [Mr. Weddikkara Kankanamge Rathnadeera, Senior Programme Officer] • **TERI – The Energy and Resources Institute** [Mr. Anshuman, Associate Director, Water Resources Division] • **IWRI – International Water Management Institute** [Mr. Bharat Sharma, IWMI-Delhi] • **ICID – International Commission on Irrigation and Drainage** [Mr. Avinash C Tyagi, Secretary General] • **ADB – the Asian Development Bank** [Representative TBC] • **UNESCO – United Nations Educational, Scientific and Cultural Organization** Mr. Ram Boojh, National Environmental Officer, Ecological Sciences, UNESCO Office in India Discussions and recommendations	
18:00	18:15	Summary of the day, introduction of Day 3 activities	

Day 3		**Wednesday, 7 November 2012**	
9:00	9:15	Introduction of Day 3 activities	
9:15	9:45	• **Technical Presentation:** *"Water Quality Assessment and Control"*; [Ms Yvonne Stokker, GEMS/Water Team Canada - includes 10 min of Qs/As]	
9:45	12:15	**DISCUSSION SESSION 1** – *"Water quality issues and challenges – Capacity building for water quality monitoring and assessments. The role of the GEMS/Water Programme".* Organization of work, objectives and expected outcomes. Guiding questions to be distributed. Last 30 min for organizing and presenting a summary of the recommendations/ actions. *Coffee/Tea to be taken during the discussion session*	
12:15	12:30	Summary of Session – conclusions, and recommendations to Workshop [by Facilitator]	
12:30	13:45	*Lunch*	

14:00	14:30	• **Technical Presentation:** *"GEMStat – the global water quality database";* [Ms Yvonne Stokker, GEMS/Water Team Canada – includes 10 min of Qs/As]	
14:30	17:00	**DISCUSSION SESSION 2** – *"Applications of water quality data and information to support decision making and national and regional water quality monitoring programmes – The role of the global water quality database GEMStat."* Organization of work, objectives and expected outcomes. Guiding questions to be distributed. Last 30 min for organizing and presenting a summary of the recommendations/ actions. [Coffee/Tea to be taken during the discussion session	
17:00	17:15	Summary of Session – conclusions, and recommendations to Workshop [by Facilitator]	
17:15	17:30	Summary of the Day 3; introduction of Day 4 activities	

Day 4		**Thursday, 8 November 2012**	
9:00	9:15	Recap and introduction of Day 4	IWF/ UNEP
9:15	11:15	**Plenary** – *Bringing everything together* • Conclusions and recommendations of the last 2 days: challenges, needs and resources available through the network. • What can the UNEP GEMS/Water Programme effectively do to answer to those needs? • The role of network members in capacity building – Expertise available through the network, transferring technology and expertise, submission of water quality data to the GEMStat. • Interaction and collaboration with other water quality monitoring initiatives (global, regional and national) Possibilities and challenges for funding/resource mobilisation.	
11:15	11:45	**Wrap up.** Conclusions and recommendations. The way forward – actions to implement recommendations.	UNEP GEMS/ Water
11:45	12:15	**Closing of the workshop:** final remarks [Group Photo]	
12:30	13:45	*Lunch*	

CONCURRENT AND SIDE EVENTS

Day 3		Wednesday, 7 November 2012	
9:00	18:00	**CONCURRENT EVENT – "Water Quality Monitoring in India: Challenges and Opportunities"**	IWF/ UNEP
9:00		Organization of work, objectives and expected outcomes; introduction of participants. (The event will be conducted in an interactive Panel-format)	
		Technical Session I: Ground Water Quality Resources Monitoring & Assessment • Topic-I: Ground Water Quality Monitoring Methods, Management and Analysis • Topic-II: Modeling the Analysis of Organic and Inorganic Contaminants • Topic-III: Ground Water Quality Problems & Remediation programs – Case Studies	
		Technical Session II: River Water Quality Assessment and Relationship to River Basin Planning • Topic-I: Water Quality Assessment of River Basins: Methodology and Analysis • Topic-II: Effects of Reservoir release Patterns on Downstream River Water Quality, algal growth potential and distribution of toxic metals- Case Studies • Topic-III: Vulnerabilities of River Water to Pollution and Modeling Plans for Water Quality Management	
12:30	14:00	*Lunch*	
12:30	14:00	**Technical Session-III: Water Quality Monitoring Networks** • Topic-I: National/Regional Water Quality Monitoring Networks • Topic-II: Water Quality Network Designing • Topic-III: Trans-boundary River Water Quality Monitoring Networks	
		Technical Session- IV: Regulatory, Policy and Management Aspects of Water Quality Monitoring and Assessment • Topic-I: Water Quality monitoring and assessment protocols • Topic-II: Utility of Sensors & Data Loggers in Water Quality Monitoring • Topic-III: National and State-level Water Quality data-bases • Topic-IV: Role of Water Quality Assessment Authority/Other Agencies	
17:30	18:00	Summary of the event: conclusions and recommendations	

Day 4		Thursday, 8 November 2012	
9:00	12:00	**SIDE EVENT – "Youth and Capacity Building in Water Quality Monitoring"**	IWF
		Introduction of session, panel members or presenters and modalities (Facilitator) • Topic-I: Safe Drinking Water is Everyone's Right • Topic-II: Role of Youth in Water Quality Monitoring • Discussions and recommendations [Tea break included]	

Annex III – Brief Summaries of Presentations at Inaugural Session

Address by Arvind Kumar

Dr Arvind Kumar, President of the India Water Foundation (IWF), delivered the welcome address emphasizing the vision for an all-inclusive collective approach in tackling water related issues by bringing all stakeholders on a common platform to share their expertise, eliciting global support for local and regional water challenges and problems.

Address by Minister Harish Rawat

The Union Minister of Water Resources, Mr Harish Rawat, emphasized collaborative efforts needed to achieve the objective of building global water quality data bases and providing quality control support to countries in the region, including India. He also lamented at the deterioration of both surface and ground water quality, and their impact on environment has emerged as core issue for sustainable water resources management. The Minister also referred to the new National Water Policy of the Government of India, pointing out that the environmental needs of aquatic ecosystems, wetlands and embanked flood plains need to be recognized and taken into consideration for planning purposes. While asserting that water quality monitoring and assessment were one of the most important aspects of water management, he averred that it had been accorded importance over the years in view of growing concerns of deteriorating environment and its adverse effects on human health. The Minister called on the participants to the workshop to make the outcomes beneficial to all, and hope for the new insights gained thereby to be helpful in improving water quality monitoring mechanisms at the local, national, regional and international levels.

Address by Minister Pradip Jain

The Union Minister of State for Rural Development, Mr Pradip Jain, spoke extempore in Hindi, mentioning the multiple hazards being faced in ensuring the supply of drinking water in rural parts of India. He exemplified his point by referring to acute shortages of clean and safe drinking water in his home constituency, the Bundelkhand region. Mr. Jain alluded to the need of the involvement of civil society organizations and public participation for ensuring implementation of actions to reverse the situation. He also informed the audience of an allocation of Rs 40,000 crore (approximately USD$ 750 Million) from the Ministry of Rural Development for integrated watershed management programme. Lack of proper governance, cooperation, coordination and absence of ownership, added the Minister, made this work more cumbersome..

Address by Secretary Sudhir Krishna

In his brief address, the Secretary of Union Ministry of Urban Development, Mr. Sudhir Krishna, emphasized the collaborative efforts for ensuring sustainable supply of potable water with increased frequency of water quality monitoring. While dwelling on the growing scarcity of fresh drinking water in urban areas in the wake of rapid pace of urbanization and increasing industrialization, and stress on water resources and problems of pollution, the Secretary cited some examples of recuperation of water bodies like the Sabarmati River – once almost a drain – as well as Nijam Sagar Lake in Hyderabad and Chinat in the outskirts of Lucknow. He further suggested that there should be no segregation in rural and urban areas in water schemes. Productivity increases cannot happen at the expense of clean, healthy and safe drinking water, he concluded.

Address by Secretary Pankaj Jain

The Minister of Drinking Water & Sanitation informed about a large budgetary allocation in his ministry for providing safe and secure drinking water for rural areas, and out of that, 3% was exclusively for water quality. Asserting that source for urban water supply was mainly from surface water and the source of water supply for agriculture was from groundwater, he called for a common system of water supply. He emphasized the need to artificially recharge groundwater sources. Highlighting the number of contaminants found in drinking water (such as fluoride, arsenic, iron, aluminum etc.) Mr. Jain informed that a national goal of his ministry was to have safe and secure drinking water in adequate quantity, water quality testing labs in 755 districts and 1050 sub districts, national rural drinking water and monitoring programs in testing samples of water. He expressed optimism that by 2022, 90% of rural population would get connections of safe secure and adequate drinking water.

Address by H S Gupta

The Director of the Indian Agricultural Research Institute lamented that the problem of water scarcity was further compounded by pollution. He expressed the hope that the present water use efficiency in India, which is about 35% to 38%, could be increased to 90% through sincere and diligent efforts. He reminded that robust efforts were required to correct the problem and positive examples to be replicated.

Address by Y P S Mohan

The Chief Post Master General (Delhi Circle), Department of Post, Ministry of IT and Communications got the Special Cover released for the occasion. He expressed serious concern over the alarming pace of depletion of groundwater resources and lamented the low level of awareness among public and decision makers on water quality issues.

Address by Norberto Fernandez

Dr. Norberto Fernandez, Manager of the GEMS/Water Programme mentioned that though Asia and the Pacific region has the largest resource of freshwater, it has the lowest per capita water availability. He further asserted that water quality was under stress due to climate change, chemical pollution, unchecked land use, global and local threats etc. Water quality data availability and sharing continue to be a big challenge to understanding and assessing water quality on freshwater ecosystems to support planning and management. The GEMS/Water monitoring programme promotes access and sharing of data and information on water quality. He reminded the audience that it was time to fill the gap in getting proper data of water quality. He hoped that the three-day regional workshop would serve to advance knowledge in water quality monitoring, to share experiences and understanding of the water quality situation of the region so that environmental sustainability and growth could be achieved.

Annex IV – Questions & Guidelines for Group Discussions

Discussion Session 1

Water quality issues and challenges – Capacity building for water quality monitoring and the role of the GEMS/Water Programme

Purpose:

- To determine the most pressing issues for regional/national capacity building in water quality monitoring, data analysis and information archiving and sharing, and the role/niche for GEMS/Water in supporting that capacity building in the technical areas.

Expected outcomes of the discussions:

- Identification of the most relevant, priority issues/challenges for building capacity to support water quality monitoring, data acquisition and sharing.
- Identify viable actions that could be implemented in the short term by organizations/members of the GEMS/Water Programme (where GEMS/Water could clearly and realistically help), to help overcome the challenges identified and increase the submission of raw water quality data to GEMStat and strengthen your country's water quality monitoring programme and participation in the GEMS/Water Programme in general.

Questions to guide discussions

- What are the key water quality issues in your country/region?
- What are the main challenges your organization/government faces in your country/region for monitoring water quality in national and shared inland water bodies?
- What is the general purpose/objective of water quality monitoring programmes in general and how is it linked to the development of management plans and policies for the protection and conservation of inland waters? (Outline linkages between WQM and organizational structure to link activity to management and policy development centres.)
- What is the known institutional set up for data access and sharing policies and protocols in the region/countries?
- What are the main issues affecting data sharing at the country, regional and international levels?
- What is the niche for GEMS/Water to help/complement national and regional level efforts and projects/activities in water quality monitoring, data gathering and sharing?
- How does your institution normally distribute water quality data amongst clients in your country, region and/or at the international level?
- Who are the users or identified clientele of your monitoring programmes and the data they produce? How do you know the data (and data products) your organization provides is what the users need?
- What are the recognized benefits for data access, sharing and distribution?
- What are the estimated financial implications to date and those for the future of water quality monitoring? Does your WQ monitoring authority use a modern approach that "monitors smart"? Does it have a strategically designed monitoring network for best efficiency? Does it have protocols to handle unforeseen WQ hotspots, emergencies, etc?

- Are the current institutional arrangements between GEMS/Water and participating institutions working towards increasing data and information sharing at national, regional and global levels? Do we need to revise this approach?
- Regionalising GEMS/Water: Regionalisation has been suggested as one of the options for the GEMS/Water Programme's way forward. What would be the criteria for selecting "Champion" agencies/institutions in countries and what would be their role?

Discussion Session 2

Applications of water quality data and information to support decision making and national and regional water quality monitoring programmes – The role of the global water quality database GEMStat

Purpose:

- To discuss applications of (GEMS/Water) water quality data and information, the status of the GEMS/Water global network and database (GEMStat) and specifically their value to country and regional needs.

Expected outcomes of the discussions:

- Identification of clear examples for application of water quality data and information (especially from GEMS/Water) that can help to raise the profile and importance of water quality in decision making processes.
- Full understanding of possibilities offered by the GEMS/Water Programme, its global network and intelligent online data systems GEMStat
- Identification of the most relevant, priority issues/challenges for an active participation in the global GEMS/Water network and for using GEMStat.
- A set of viable actions to be implemented in the short term by organizations/members of the GEMS/Water Programme, to help overcome the challenges identified and increase the participation of organizations in the global network and the use of the GEMStat intelligent online data system by altering perceptions of the values in doing so.

Questions to guide discussions:

- Name some relevant examples of applications of GEMS/Water data and information – how useful is it for scientific research/applications, and for decision makers in creating water policy guidelines?
- Which areas in development and environment would benefit from development of baseline studies, regional/global water quality assessments? How can these studies assist countries to improve in the water, health, domestic, industrial and agricultural sector?
- Which areas in Science and technology do you think that the GEMS/Water data and information would be applied?
- Using water quality data at national level, what are the possibilities for regional status updates through publications? What are the benefits
- Would the development of indices, standards and guidelines for water quality assist countries in sharing data and information? Who are the immediate beneficiaries?
- Data gaps: Where are the data gaps? How do we cover these data gaps and improve the reliability and comprehensiveness of country-level water quality data?

- Are you conversant with the GEMS/Water global network and its database GEMStat (http://www.gemstat.org/)
- How many sampling sites do you devote to providing data and information to GEMS/Water? To what extent do these represent an accurate picture of the status and trends of inland water resources in your country?
- What challenges do you face in obtaining and sharing/distributing data in the process?
- How do we increase the acceptance of the value of countries participating in the network and for the provision of raw data to the global database?
- What do you see are the benefits and incentives for national agencies and organisations to participate in the GEMS/Water global network? What is missing?
- Are the GEMS/Water Programme and GEMStat perceived as value-added activities in your country/region? If not, why not and how can this perception be changed so as to increase national/regional use and relevance of data and information on water quality?
- Which water quality assessment activities are required to generate better and more national/regional data and information for the network and database?
- Are the current institutional arrangements between GEMS/Water and participating institutions working towards increasing data and information sharing at national, regional and global levels? Do we need to revise this approach?
- Regionalizing GEMS/Water: Regionalization has been suggested as one of the options for the GEMS/Water Programme's way forward. What would be the criterion for selecting the "Champion" agencies in countries and what would be their role?

Annex V – Summary of Presentations by GEMS/Water National Focal Points

Mongolia

Title: Status of Surface Water Quality in Mongolia

This presentation makes it discernible that central environment authority is the main Regulatory authority established in 1981 for the protection management and enhancement of water environment, regulation, maintenance and control of the water quality of environment, prevention, abatement and control of water pollution. Water quality monitoring programme for 62 sampling locations is being carried out for several selected surface water bodies once a month for PH, electrical conductivity, turbidity, temperature, dissolved oxygen, chemical oxygen nutrient heavy metals and microbilogical contaminant etc. The data have been regularly submitted to GEMS/Water since 2005 continuously. The data are also utilised for the environmental impact assessment activities by various organizations especially for drinking water and irrigation projects. Some data are utilised as baseline data for highway development projects etc., also. The challenges enumerated in this presentation inter alia include:

- Very limited data available;
- Non-availability of gathered data on surface and ground water quality;
- Non-availability of some areas such as stream flow and rainfall;
- Pesticide pollution in water leading to a sudden surge in kidney ailments;
- No baseline study for major resources
- Lack of laboratory Capacity for water quality monitoring work
- Non availability of capacity building programme for laboratory staff

Sri Lanka

Title: Status of Water Quality in Dadugam Oya, Sri Lanka

This presentation makes it discernible that central environment authority is the main water quality monitoring authority and it was established for the protection, management and enhancement of water environment, regulation, maintenance and control of the water quality of environment, prevention, abatement and control of water pollution. Water quality monitoring is carried out for several selected surface water bodies once a month for PH, electrical conductivity, turbidity, temperature, dissolved oxygen, chemical oxygen etc. The data have been regularly submitted to GEMS/Water since 2005 continuously. The data are also utilised for the environmental impact assessment activities by various organisations especially for drinking water and irrigation projects. Some data are utilised as baseline data for highway development projects etc., also. The challenges enumerated in this presentation inter alia include:

- Very limited data available;
- Non-availability of gathered data on surface and ground water quality;
- Non-availability of some areas such as stream flow and rainfall;
- Pesticide pollution in water leading to a sudden surge in kidney ailments;
- No baseline study.

India

Title: Water Quality Monitoring in India: Achievements and Constraints

This presentation makes it noticeable that the Central Pollution Control Board (CPCB), in collaboration with state pollution control boards, has established a water quality network. This network was initiated with the help of GEMS/Water when WHO was the sole agency and it started operations with few monitoring stations. All kind of technical know-how was gathered by GEMS/Water. The CPCB's objective is rational planning of pollution control strategies and prioritization, assessing nature and extent of pollution control needed in different water bodies, to evaluate effectiveness of pollution control measures already in existence, evaluating and assessing the water quality trend over a period of time and assimilative capacity of a water body thereby reducing the cost on pollution control etc. Presently, there is a network of 2500 stations covering 445 rivers at 1275 locations, 281 lakes, tanks, ponds and 41 regions of creeks/ sea water and 807 ground water locations.. Water samples are analysed for 9 core and 19 general parameters monthly. Bio-monitoring and analysis of trace metals and pesticides is also carried out at selected locations. Monitoring network is operating 1687 monthly stations, 807 stations on half-yearly basis (pre and post monsoon season) and 6 locations annually (approachable during summer season only) . Annually water quality status is published and circulated; basin and sub-basin inventory of water pollution is prepared and published for major river basins of the country. Besides, water quality atlas is prepared envisaging identification of polluted water bodies. The challenges envisaged in this presentation include:

- Sustainability of infrastructure and maintenance of instruments and equipment;
- Inadequate manpower and financial resources;
- Lack of trained field staff and laboratories;
- Data validation due to fluctuation in water quality.

Cambodia

Title: Water Quality Monitoring Networks in Cambodia

The Ministry of Water Resource and Meteorology plays role as mainline agency to implement activities since 1993. WQMN at the lower Mekong river Basin is a complementary task to the environment program funded by SIDA through Mekong River Commission in cooperation with National Mekong Commission. There are around 19 stations to monitor water quality with 18 parameters, including physical, minerals and microbiological. The main purpose of this is to provide timely data and / or information on the status of changes in the water quality of Mekong River Basin. To access that purpose, annual water quality data assessment report is published with two main categories of water quality indices (WQI) used for the protection of aquatic life and for human impact. There exists cooperation in the form of a MOU, agreement or contract between Combodian government (MOWRAM) and the users, for e.g. WQMN, and they have good cooperation. There is also an agreement between MRC and CNMC/MOWRAM since 1993.

Lao PDR

Title: Water Quality Monitoring Network in Lao PDR

Water Quality Laboratory (WQL) of the Department of Irrigation was established in 1985 as part of MRC WQMN, supported by SIDA through Mekong River Commission and Lao National Mekong Committee. The main role of WQL is to monitor water quality of Mekong River and its tributaries within the national boundary of Lao PDR, to maintain, analyse and store database. The Lab constantly collaborates at national level with several ministries etc and at regional level with other designated laboratories of WQMN in Combodia, Thailand and Vietnam. The focus of monitoring is mainly surface water quality. The water quality data are recorded into the database and forwarded to MRC through LNMC annually. The data are used to detect changes in water quality of the Mekong River, e.g. hydropower on Mekong mainstreams and its tributaries. Before building dams, these projects need to have baseline water quality data for their assessing impact on water quality during construction and operation phase. The challenges facing the WQL inter alia include lack of capacity to monitor and analyse, limited skilled human resources, funds and updated equipments.

New Zealand

Title: Water Quality Monitoring in New Zealand

This presentation makes it discernible that the National Institute of Water and Atmospheric Research (NIWAR) is a government institute having main role in water quality monitoring. The national river water quality network has 77 sites on 35 large rivers upstream and downstream. NIWAR provides tools for monitoring like river environment classification, statistical tools, assistance in national protocols and guidelines of water quality data acquisition. We have developed Stream Health Monitoring Assessment Kit (SHMAK). Various variables measured monthly are physicochemical, optical, nutrients, biological, and microbial is annually and flow continuously. The data collected by NRWQN is for national and regional reporting for special reports, and for scientific research in water management decisions. The challenges enumerated in this presentation are as follow:

- Maintaining stability of NRWQN in rivers;
- Lakes- no national network, regional council sites biased towards large lowland lakes;
- Wetlands- no national monitoring, little regional monitoring;
- For all- not enough reference, hard to distinguish local impacts from global changes;
- National SOE reporting on rivers and lakes difficult- NRQWN limited to large rivers, regional council sites not randomly located;
- Variables and protocols differ among councils;
- Lack of consistent indices for policy makers and public;
- Very large monitoring network.

Singapore

Title: PUB's Water Quality Monitoring Program for Safe Management of Drinking Water

This presentation reveals that Public Utilities Board (PUB), under the Ministry of Environment and Water Resources, was constituted in 2001 to provide integrated water supply, sewerage and drainage services, and drinking water supply from four different sources- water from local catchment, imported water from Malaysia, new water (treated water) and desalinated water. The PUB manages the complete water cycle- from sourcing, collection, purification and supply of drinking water and treatment of used water and turning into New Water to water safety plan- system assessment, monitoring and management. The PUB also audits the water quality monitoring plant. The water quality strategies are online, daily and weekly to annually. 314 parameters are monitored.

Vietnam

Title: An Overview of Water Quality Monitoring in Vietnam

This presentation reveals that Institute of Water Resources Planning (IWRP), established in 1961, is equipped with standard water quality laboratory for conventional and advanced water quality assessment. Parameters assessed are physicochemical, biological and heavy metals, organic poisons and pesticides. Data used in water supply calculation, contamination tracking and water quality assessment in river and irrigation systems. It is also used in water resources planning and management related projects. The IWRP also provides warning in case of water quality contamination. Data from upstream parts are analysed and sent to state agencies. However, the presentation laments at poor and worsening water quality.

Annex VI – Summary of Presentations by Regional and International Organisations – including the UNEP GEMS/Water

South Asia Co-operative Environment Programme (SACEP)

This presentation makes it discernible that SACEP is an inter-governmental agency established in 1982 with all major South Asian countries as its members. It deals with all environmental issues of trans-boundary nature. It's Governing Council – the highest level policy making body – consists of the environment ministries of the member countries who meet annually. SACEP's major concern is coastal water as all countries share coastal water. It has a program called South Asian Seas Program which is one of the 18 regional programs of UNEP. It facilitates major discussions at ministerial levels of member countries and capacity building needs of various institutes of environment concern at the national level and assisting member countries for building their capacity in that area. It can be a very good platform for establishing regional discussions and regional initiative. It has initiated a program to establish environmental data and information management system for South Asia covering all the sectors including water.

International Water Management Institute (IWMI)

This presentation reveals that IWMI conducted a comprehensive assessment of the agricultural use of marginal quality water. Waste water used in irrigation often contains pollutants and saline and sodic water contains salts that impair plant growth. Undoubtedly, demand and supply of waste water for irrigation is increasing, but its off-farm and long-term implications can be substantial. The options are – manage and minimise risks, nutrients in waste water contribute to crop growth but monitoring needed, ground water recharge, untreated waste water not to be used for crops as it transmits pathogens to consumers, leaching and drainage required etc. The IWMI places ample emphasis on resource recovery and reuse. Several projects are going on under 3Rs. Important partners in Asia-Pacific region include – national and state groundwater boards, river water quality monitoring agencies, universities, special Institutes, regional and global database. It is also engaged in improving water and land resource management for food and livelihoods as well as also working extensively with neighbouring countries.

International Commission on Irrigation and Drainage (ICID)

It becomes discernible from this presentation that the International Commission on Irrigation and Drainage (ICID) is the oldest water related international organisation, an inter-governmental body with a nature of international NGO, which is represented by 110 member countries and mainly represented by Irrigation and Water Resources departments of member countries. It believes that the hydrological and water quality observations are closely linked. The ICID provides common platform to all the stake holders for managing of water quality, the most important issue for any agency in water quality monitoring.

Central Asia Regional Economic Cooperation (CAREC)

CAREC was established in 1998 and commenced its operations in 2001. The founding members of the CAREC are the Central Asian countries Kazakhastan, Uzbekistan, Tazakhistan, Kyrgyzstan and Turkmenistan, and the United Nations Development Programme (UNDP) and the European Commission. CAREC's mission is to promote multi-sector cooperation in addressing environmental problems in Central Asia at local, national and regional levels. Its objectives are: to establish intersectoral dialogue in Central Asia, create opportunities to attract advanced knowledge, best international practices and technologies in field of environmental management and sustainable development, enhancing role of civil society in the field of environmental protection. CAREC is engaged in carrying out a water quality project in Central Asia implemented with United Nations Economic Commission for Europe (UNECE). The presentation emphasized that for successful trans-boundary cooperation it's necessary to consider interests of each involved country, have political will and financial support to regional structure for organising meetings, involving experts etc., along with a multi-stakeholder approach and negotiation process.

Annex: VII – List of Topics and Summary of the Presentations Made at Special Session on "Water Quality in India: Challenges & Opportunities."

Fluoride contamination in Ground Water of West Bengal:

Presentation highlighted and discussed geogenic cause of fluoride contamination in groundwater of 7 districts of State, reduction and removal of fluoride contaminations through seneficeanes participants and using combination of electro-coagulation and activated alumina technique in rural habitations. Technical options implemented successfully with beneficiaries participation towards reduction and removal of fluoride contamination.

River Water Pollution Modeling:

Presentation by IIT Delhi demonstrated pollution transport modeling approach to track and monitor water pollution. Discussions were held around wastewater generation and water pollution scenario in India.

River Quality Assessment and Relationship to River Basin Planning:

Delhi Jal Board (DJB) presentation veered round discussions on construction of Interceptor Sewer for Improving Water Quality of River Yamuna in Delhi with multi-agency involvement. It has targeted to achieve CPCB laid standards of BOD and SS after completion of project.

Monitoring Non-Point Source Pollution:

NIH, Roorkee demonstrated and discussed an approach of upstream and downstream monitoring of pollution in Kali River through use of non-point source pollution model.

Eco-System based policy approach for Integrated Water Resources Management (IWRM)

Narmada River Control Authority discussed the need for river basin authorities under River Board Act 1956 and suggested control of eutrophication and need for water catchment zoning along with implementation of projects through community participation.

Water Management Intervention:

In its presentation, AFPRO, an NGO, described and discussed the mapping of the contamination of drinking water sources, problem of data validation, preservation of water sampling protocol, lack of training and data analysis software.

Water Quality Assessment of River Basin in India:

The Central Water Commission (CWC, MoWR) described the role in monitoring surface water quality for 396 sites on river and procedure of sampling protocol and aspects of imparting training in laboratory analysis of water sample. It highlighted threats to surface water quality due to entreplication, oxygen depletion and ecological health of streams and rivers.

Role of Water Quality Assessment Authority:

The WQAA's presentation described its role of exercising power to control water quality and water pollution under Environment Protection Act 1986. It also informed about its notification on Uniform Water Quality Monitoring protocol (UWQM) of 2005 and guide manuals on water quality monitoring.

Ground Water Quality of NCT Delhi:

CSIR-NEERI described and discussed the results of Ground Water Quality Monitoring conducted through 262 sampling wells in Delhi for drinking and irrigation use and highlighted problems of excess fluoride and TDS in groundwater.

JICA Approach to Urban Water Sources in India:

The presentation discussed and described role of JICA in water supply and sewerage and mitigation of Fluorosis in India. It discussed the benchmark developed by it for water supply and sewerage system, capacity building and awareness generation programmes being implemented by it.

Water Quality Status of Meghalaya, India:

The state level presentation discussed water quality monitoring being done in state over 20 rivers & streams, 4 lakes and 7 springs & wells. Rivers have been seen to have high organic pollutants. Excess iron is reported from 102 habitations in the state. The state has launched Water Quality Sub-mission for strengthening water quality monitoring system.

Ground Water Quality Monitoring Scenario of India:

The Central Ground Water Board (CGWB, MoWR, GOI) described monitoring of ground water quality through a network of 15640 observation stations in India, in which 26 parameters are tested at 16 regional laboratories. It discussed problems of arsenic, fluoride, salinity in various district and states of Indi with a special reference to Uttar Pradesh state.It also made aware of its year book publication on water quality issued on annual basis for public use for different states

Water Saving measures in Rice Growing Areas of Haryana State – Corporate Presentations

DUNAR discussed and described water saving techniques to include lesser land leveling and use of tensiometer with direct seeded rice. It informed of its efforts to provide literature to rural former and school children on water use efficiency and water quality improvement measures

Annex VIII – Outreach Side Event: "Youth and Capacity Building in Water Quality Monitoring in India"

Presentation by - Indian Agricultural Research Institute (IARI)

This presentation, while dealing with spatial and temporal data on several natural resources, including water quality, asserted that it was a pre-requisite for any local/ regional scale decision-making in terms of priority area identification, impact assessment of on-going land/water management strategies on regional water and food security; enforcement of standards and guidelines for containing natural resource degradation, proposing cost/ time effective, environment-friendly and sustainable resource management strategies. It further noted that feasibility of these strategies was dependent on an effective data sharing across varied national data monitoring centres through a common national natural resource monitoring data centre. Besides, there is a need for standardizing data monitoring methods for ensuring quality data monitoring. Equal emphasis was also called for standardizing varied resource monitoring parameters to be used for monitoring diverse water resources across different parts of India in order to save time, efforts and resources and to facilitate effective decision making.

Presentation by – Department of Posts (India)

This presentation dwelt on the problems being faced in water sector at global, regional, national and local levels. While dealing with water problems in the Indian context, especially with regard to growing water scarcity, it laid emphasis on promoting rainwater harvesting as an effective means to meet the problem of water scarcity to some extent. It further informed that Department of Posts was devoting full attention to install rainwater harvesting mechanism in spacious postal buildings with specific emphasis on rooftop rainwater harvesting. According to presentation, over one lakh postal buildings in the country are equipped with such mechanisms and new buildings are designed in such a manner so as to have rainwater harvesting mechanism as a part of in-built system.

Conclusion of the Event

The side event provided a friendly ambience for discussions and exchanges of ideas between students, teachers, members of the water community in India and a representative from GEMS/Water. The workshop placed emphasis on data sharing and networking, data communication and enabling information for decision makers, development of projects on water quality remediation and involvement of the youth in environmental activities especially focused on improving and preserving water quality. The hildre also expressed the need for optimization of water quality monitoring networks and concerns about general inadequacy of funds in the country.

Outcomes

The following outcomes have emerged from this workshop:

- Common challenges discussed in detail included training of water quality monitoring lab staff , capacity building and infrastructure development, need for optimization of water quality monitoring networks, need for uniformity in analysis and reporting of water quality parameters.
- Need for trained manpower, improvements in monitoring and analyses equipments use and maintenance and need for specific training in data preparation and submission to GEMStat.
- Emphasis on reinforcement of global and regional collaborative water quality monitoring ventures.
- Regionalisation of GEMS/Water Programme particularly towards capacity building and water quality remediation technology need of region.
- Need for imparting tarining to the Lab personnel with the help of GEMS Water programme and other agencies.
- Need for increased interaction with GEMS/Water and GEMStat in data sharing, networking and data exchange on water quality.
- Emphasis on an all-inclusive collective approach in tackling water related problems by bringing all stakeholders on a common platform to share their expertise, exchange knowledge and experiences and networking.
- Eliciting global support for local water related problems,
- Capacity building of the people by sensitizing them on water issues in order to elicit their participation and support by galvanizing them.
- Harnessing youth potential in capacity building and in sensitizing the people about the urgency for water quality monitoring.
- Emphasis on convergence in water sector by involving all stakeholders specially non water sector like India Post in India having around 1,75,000 branches all over India even in the remotest of villages can be partner in sensitizing and data collection in order to ensure quality sustainable supply of water and making water as a goal of sustainable development.

Event Photo Annexure (1-15)

1. Registration desk; 2. Dr. Arvind Kumar, Mr. H S Gupta, Mr. Pradeep Jain, Mr. Sudhir Krishna, Mr. Y P S Mohan; 3. Dr. Norberto Fernandez; Dr. Arvind Kumar, Mr. H S Gupta; 4. Dr. Arvind Kumar, Mr. Harish Rawat; 5. Dr. Arvind Kumar, Mr. H S Gupta, Mr. Pankaj Jain, Mr. Harish Rawat, Mr. Pradeep Jain, Mr. Sudhir Krishna, Mr. Y P S Mohan, Dr. Norberto Fernandez; 6. Dr. Arvind Kumar, Mr H S Gupta, Mr. Harish Rawat, Mr. Pradeep Jain, Mr. Y P S Mohan; 7. Mr. Harish Rawat; 8. Mr. Pradeep Jain; 9. Ms. Shweta Tyagi; 10. Ms. Nhim Sophea (Cambodia); 11. Mr. Bui Nam Sach (Vietnam), Mr. Jinhua Xhang; 12. Mr. R M Bhardwaj (India); 13. Mr. Woo Chee Hoe (Singapore); 14. Ms. Yvonne Stokker (Canada), Mr. Patrick L Mmayi; 15. Dr. Richard Storey (New Zealand), Mr. Woo Chee (Singapore), Mr. Bui Nam Sach (Vietnam)

Event Photo Annexure (16-30)

16. Mr. Bharat R Sharma, Mr. Avinash Chnad Tyagi, Mr. W K Rathnadeera, Ms. Guljamal Jumamuratova; 17. Mr. Bui Nam Sach (Vietnam); 18. Ms. Yadamsuren Erdenebayar (Mongolia); 19. Mr. Woo Chee Hoe (Singapore); 20. Meeting room; 21. Dr. Ravinder Kaur; 22. Ms. Savita Agarwal, Mr. Shiv Harit; 23. Mr. S K Mishra; 24. -28. Students' Interactive Session; 29. Dr. Norberto Fernandez; 30. Students' Interactive Session

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