



IAEA-TCR-04642

INTERNATIONAL ATOMIC ENERGY AGENCY

END OF MISSION REPORT

“End of Mission Report”

Malaysia

2009-04-20 to 2009-04-24

by

Mr Manzoor Ahmad Choudhry

(RAS8108)

**“Assessing Trends in Freshwater Quality Using Environmental Isotopes and
Chemical Techniques for Improved Resource Management (RCA)”**

**Asia and the Pacific Section
Department of Technical Cooperation**

Department of Technical Cooperation (TC)

End-of-Mission Report

Report Title:	IAEA/RCA Executive Meeting on Application of Isotope Techniques to Solve Hydrological Problems (RAS/8/108)
Project Number:	RAS8108/9001/01
Project Title:	Assessing Trends in Freshwater Quality Using Environmental Isotopes and Chemical Techniques for Improved Resource Management (RCA)
Name of Expert:	Manzoor Ahmad Choudhry
Dates of Mission:	20 - 24 April 2009
Counterpart: <i>Please provide full contact details for the Institute and main counterpart</i>	Mr. Mohd Abd. Rahman Ministry of Science, Technology and Innovation Malaysian Nuclear Agency Bangi 43000 Kajang Selangor Malaysia Tel.: 0060 3 89282972 Fax: 0060 3 8925 0907 Email: Mohd_Tadza@nuclearmalaysia.gov.my

Terms of reference:

Describe the specific objectives of the assignment and the duties to be performed by the expert as they relate to the objectives.

The specific objective of the assignment was to assist in the coordination of "IAEA/RCA Executive Meeting on Application of Isotope Techniques to Solve Hydrological Problems (RAS/8/108)" and in reviewing implementation of project. Main purposes of the meeting were:

- to discuss with the senior executives/professionals of participating RCA Member States on the emerging issues in water resources development and management
- to deliver lectures to provide them knowledge of advantages and utility of isotope techniques in water resources management.

Duties performed by the expert:

Describe the work carried out to meet the terms of reference as set out above. Please include any technical, logistical, administrative and other problems encountered, and any other considerations of importance. Please include also the Agenda and List of persons met.

NOTE: Figures, tables and annexes should be mentioned in the body of the text and should be numbered in the order in which reference is made to them (e.g. Fig.1, Fig. 2, Table 1, Table 2, Annex 1, Annex 2, etc.). All attachments should be clearly labeled.

Mission Implementation

The following duties were performed before the mission:

- Correspondence was done with the participants and the National Counterparts of the RCA Project through email system for submission of country reports.
- Assisted the Technical Officer to prepare tentative agenda of the meeting. The Agenda is attached as Annex 1.

During assignment period, the following tasks were done.

Presentation of overview of the project:

Overview of the RCA project including objectives, participating countries, regional activities (meetings, training courses, expert services, isotope analytical services), outputs, outcomes, expected impact, problems / constraints, inputs required from IAEA, achievements/general progress, suggestion for improvement was presented.

Presentation of Country Reports

The following country reports were presented by the participants.

Bangladesh: Mr. Mizanur Rahman,
Application of Isotope Technique to Solve Hydrological Problems in Bangladesh

Mr. Nasir Ahmed
Use of Environmental Isotopes to Study Deep Groundwater Resources in Alluvial Deposits of Singair Upazil and Manikganj Districts

China: Mr. Zhiming Wang

Isotopes and Geochemical studies on Surface water and groundwater quality in Huaihe River Area

India: Mr. Kavallappa Shivanna,

Isotope and Geochemical Approach for the Rejuvenation of Drying Springs in Himalayan Region of Gaucher Area, Uttarakhand, India

Mr. K.Tirumalesh

Impact Assessment of Sewerage Network on the Groundwater System of Arkavathi and Vrishbhavati Basins of Bangalore, Karnataka using Hydrochemistry and Environmental Isotope Techniques

Indonesia: Mr. Syamsu Daliend

Environmental Isotopes and Chemical Techniques for Improved Groundwater Resources Management at East Kalimantan

Korea: Mr. Geon Young Kim

Application of isotope techniques and hydrological and hydrochemical investigation techniques to solve the geogenic contamination, especially about high uranium contents of groundwater

Malaysia: Mr. Mohd Tadza Abd. Rahman

To assess the trend of freshwater quality in Langkawi Island

Mr. Mohammad Hatta Husin and Mr. Amran Kamaruddin

Application of isotope techniques to solve hydrological problems due to sewage seepage into groundwater in Kelantan State, Malaysia

Myanmar: Ms. Thu Zar Lwin Oo

Overview of water problems in the country

Pakistan: Mr. Allah Bakhsh Sufi

Water resources of Pakistan – current Issues and way forward

Philippines: Mr. Francisco Arellano and Mr. Ferdie Billones

Philippines Country Report

Sri Lanka: Mr. Galapitagedara R.R. Kuranaratne, Mr. S.K.S.K. Harsha Suriyaarachchi

Investigation of the Trends in Water Quality Deterioration of Northwestern Limestone Aquifer System of the Puttalam District

Thailand: Mr. Adisai Charuratna

Application of Isotope Hydrology for Solving Nitrate Genesis in Groundwater Northeastern Part of Thailand

Mr. Kriengsak Srisuk

Use of Isotope Hydrology for Groundwater Resources Study in the Upper Chi River Basin, Chaiyaphum, NE-Thailand

Vietnam: Mr. Nguyen Kien Chinh

To define the source of nitrate in groundwater of Hochiminh City using isotope techniques

Lectures:

Lectures on "Basic Principles of Isotope Techniques and case studies", including introduction to stable isotope and radioactive environmental isotopes, Isotopes in water cycle, investigation of recharge mechanism, groundwater dating, surface water-groundwater relationship using isotope techniques and case studies were delivered.

Identification of water-related issues in the Member States:

On the basis of the presentations made by the participants surface water/groundwater issues in the RCA region along with the information required were identified. Detail is given below.

Country	Problem	Information required
Bangladesh	Arsenic contamination of shallow groundwater in Singair area	-Better understanding of As source and release mechanism -Interconnection between shallow and deep layers -Groundwater dynamics
	Point source contamination of groundwater (industrial, landfill)	-Contaminated river water inflow to aquifer
	Sustainability of Dhaka aquifer	-Recharge area and potentiality of aquifer corridor
China	Contamination of surface water and groundwater in Huaihe River Basin by agrochemicals and industrial/urban waste	-Interconnection between surface water and groundwater -Sources and transport of contaminants
India	Contamination of groundwater by industrial and urban waste in Bangalore area, Karnataka	-Quality of groundwater -Understanding of recharge and discharge processes -Impact of sewerage drains on

		groundwater
	Radon pollution in the groundwater	-Radon and uranium levels
Indonesia	Declining piezometric levels & sustainability concerns	-Identification of recharge zones -SW-GW interaction -Groundwater potential
	Contamination of river water and groundwater by industrial and urban wastes	-Water quality and source of pollutants -Surface water inflow to main aquifer
Korea	Groundwater contamination from anthropogenic activities (mine drainage, agricultural and industrial activities)	-Groundwater quality -Interconnection between surface water and groundwater -Source & transport of contaminants
	Geogenic contamination of groundwater by uranium	-Identification of U bearing minerals and release mechanism Groundwater flow paths
Malaysia	Groundwater quality under contamination threat from both point and non point sources in Langkawi Island and Kelantan State	- Surface water – groundwater interaction - Contaminant source and migration
Myanmar	Surface water and groundwater contamination	- Quality of surface water and groundwater - Identification of contaminant sources (urban, industrial and agrochemical)
Pakistan	Impact of constructed reservoirs/canals on local groundwater system	-Lateral and vertical contribution of surface water in groundwater
	Water logging and increase of soil salinity	- Recharge sources - Salinization processes
	Contamination of groundwater from urban industrial and agrochemical waste	- Quality of SW & GW - Identification of contaminant sources (urban, industrial and)
	Groundwater sustainability	- Identification of recharge zones -SW-GW interaction -Groundwater potential
Philippines	Surface water and groundwater pollution by agricultural activities and urban waste	- Quality of surface water and groundwater - Identification of contaminant sources (urban and agrochemical)
	Seawater intrusion in coastal areas	- Delineating fresh water/seawater interface

	Sustainability of water resources (deficit)	<ul style="list-style-type: none"> - Identification of recharge zones - SW-GW interaction - Groundwater potential
Sri Lanka	Groundwater quality deterioration due to saline water intrusion in Puttalam and Anuradhapura	<ul style="list-style-type: none"> - Groundwater quality - Source of salinity
	Groundwater sustainability in Sudugala	<ul style="list-style-type: none"> - Identification of recharge zones -SW-GW interaction -Groundwater potential
Thailand	NO ₃ pollution in groundwater	<ul style="list-style-type: none"> - Identification of NO₃ source(s) - Groundwater recharge source and area
	Sustainability of water resources	Northern Part of the Chaopraya Basin, Eastern Sea Board and Hard Rock Terrain in the Kong Chi Mun Basins are facing groundwater scarcity
Vietnam	Groundwater level depletion	<ul style="list-style-type: none"> - Identification of recharge zones -SW-GW interaction - Groundwater potential
	Groundwater contamination from geogenic and anthropogenic sources	<ul style="list-style-type: none"> - Quality of surface water and groundwater - Identification of contaminant sources and transport process
	Surface water quality deterioration	-Nature of contaminants and sources

Synthesis of water-related issues into common and general themes

The individual presentations from the countries could be categorized into six common themes as: anthropogenic contamination, geogenic contamination, sustainability, surface water – groundwater interaction, groundwater salinization, education & training. These were subsequently consolidated into two general themes:

- A. Groundwater Sustainability
- B. Water Pollution Investigation

Summary of Group Discussions on General themes and issues

Group-I: Groundwater Sustainability

Information needed:

- Definition of the aquifer system including hydrostratigraphic classification
- Understanding of recharge (source, rate, area)
- Groundwater flow dynamics
- Groundwater abstraction for different purposes
- Aquifer interconnection (surface water-groundwater and different aquifers)
- Hydrochemistry of the aquifer system
- Aquifer potential

How isotopes can help:

Environmental isotopes like $\delta^2\text{H}$, $\delta^{18}\text{O}$ (water, NO_3 , SO_4), $\delta^{24}\text{S}$, $\delta^{13}\text{C}$, $\delta^{15}\text{N}$, ^3H , ^3H - ^3He and ^{14}C along with hydrochemistry can help investigate:

- ❖ Identification of ground water recharge source and area
- ❖ Flow rate and dynamics
- ❖ Aquifer interconnections
- ❖ Understanding hydrochemical evolution
- ❖ Validation of mathematical models on groundwater flow

Group-II: Water Pollution Investigation

Information needed:

- Quality of surface water and groundwater,
- Vertical and horizontal distribution of the contaminants within the aquifer,
- Information on recharge mechanism, groundwater flow paths, dynamics of the aquifer, inter-relation between aquifers, etc.
- Sources of contaminants /salinity (geogenic, urban, industrial, agrochemical, seawater intrusion etc.)

- Identification of geogenic contaminants bearing minerals and mobilization processes within the aquifer,
- Transport of contaminants, salinization processes and delineating fresh water/ seawater interface

How can Isotopes Help?

Environmental isotopes like $\delta^2\text{H}$, $\delta^{18}\text{O}$ (water, NO_3 , SO_4), $\delta^{24}\text{S}$, $\delta^{13}\text{C}$, $\delta^{15}\text{N}$, ^3H , ^3H - ^3He and ^{14}C along with hydrochemistry can help investigate:

- ❖ Origin and source of groundwater recharge
- ❖ Inter connectivity between different contaminated and non contaminated aquifers and leakage rate
- ❖ Dating of ground water to obtain information on dynamics of the groundwater flow
- ❖ Delineation of the area polluted and sources of contaminants,
- ❖ Rate, direction and distribution of the pollutants
- ❖ To understand the subsurface geochemical environmental conditions for the mobilization of geogenic contaminants
- ❖ To validate the assumptions and concepts made in hydraulic and contaminant transport predictive models

Identification of inputs required from the Agency

Discussions with the participants indicate that inputs of IAEA are mainly required to support isotope analysis, training and data interpretation for successful completion of the ongoing RCA Project and sustainable application of isotope techniques in water resources management. The Agency has already allocated budget to support the following activities, which will fulfil the requirements of the Member States.

- a) Isotope analytical services to the MSs having insufficient facilities:

b) Provision of minor equipment, spares, software, scientific supplies etc.

c) Expert Missions

- For field work designing, national training courses and national executive management seminars etc.
- For data interpretation
- Compilation of existing data and data generated through the project for IAEA ISOHIS database
- For preparation of brochure and to draft recommendations and guidelines on the application of isotope techniques

d) Regional events

- Regional Training Course on Advanced Techniques for Isotope and related applications in water resources management. Q/3 2010
- Project progress review meeting, Q4/2009
- Final Project evaluation meeting, Q2/2011

Persons Met

Mr. Mohd Noor Bin Mohd Yunus, Deputy Director General, Malaysian Nuclear Agency (MNA) and the meeting participants were met. List of the participants is given in Annex 2.

Travel

Travel Record Form:	Annex 3
Scanned Boarding Cards:	Annex 4

Photographs

Some photographs regarding the mission activities are given in Annex 5.

Conclusions:

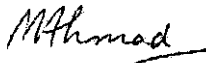
An assessment of the results and impact of the expert's mission, relevant conclusions, including an evaluation of the degree of success in solving the problems encountered. Provide an analysis and description of any additional training, expert services and equipment that are considered to be necessary if the project's objectives are to be met. Suggestions or recommendations made concerning future work should take into account the advisory role of the IAEA and the limitation on funds that may exist.

The mission has been successful in achieving its objectives. Assistance was provided to coordinate the meeting and to review the project.

The meeting helped in identification of the country specific problems and common regional themes. This meeting also assisted in disseminating the information of role of isotope techniques to the participants through lectures and case studies.

This meeting has provided a forum to discuss specific problems of each country in detail and to suggest appropriate isotope methodologies to be adopted in order to solve the hydrological problems. The requirements of the member states were discussed which would help fine-tune the functioning of national and regional activities.

The participants, especially the executives from end-users, viewed this IAEA/RCA Project as being highly worthwhile and appreciated the support of the Agency.



MANZOOR AHMAD CHOUDHRY
Deputy Chief Engineer
Head Isotope Application Division
Pakistan Institute of Nuclear Science and Technology
P.O. Nilore, Islamabad,
PAKISTAN

Email: manzoor@pinstech.org.pk
manzoorriad@yahoo.com
Phone: 92-51-2208038
Fax: 92-51-9290275

Recommendations:

NOTE: Each group of recommendations is a separate table. Please enter each recommendation in a separate row in the table. To enter a new row within each table, press the "TAB" key.

Recommendations to the Counterpart Institution and National Counterpart:
<p>Since this mission was to assist in coordination of the Executive Meeting under RCA Project RAS/8/108, therefore the following recommendation are to the Participants of the meeting and the NPCs of the project.</p> <ul style="list-style-type: none">➤ To establish strong collaborations between nuclear institutes and end-user departments and establish a team/group for application of isotope techniques in hydrology and water resources management;➤ To arrange in-house training for end-users and national workshops on a technical and managerial level;➤ To review project activities/progress of the national studies under the ongoing RCA project and ensure adaption of national work plans;➤ To improve access to analytical facilities;➤ To ensure timely submission of proper progress/final reports;➤ To disseminate results to end-users and make them aware of isotope techniques;➤ To compile isotope and chemical data of previously completed projects and ongoing project, and submit to IAEA;➤ To formulate guidelines/policies for sustainable management of water resources.

Recommendations to the Government:

Recommendations to the Governments of the Participants of the meeting are given below.

- To provide budget for establishment of isotope analytical facilities and implementation of hydrological projects using isotope techniques in combination of conventional techniques;
- To give high priority to water-related projects while submitting National Technical Cooperation Projects to IAEA in order to get the Agency's support for establishment of isotope hydrology laboratory and a proper team;
- To compel water dealing departments to integrate isotope techniques in various hydrological investigations/projects in collaboration with nuclear institutes.

Recommendations to the Agency:

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| <ul style="list-style-type: none">➤ To help establish/upgrade isotope analytical facilities through future National T.C. projects;➤ To support training fellowships and scientific visits in the field of isotope hydrology and maintenance of relevant equipment;➤ To provide isotope analytical services to the Member States having insufficient facilities;➤ To provide expert services for facilitation of national training courses and workshops on technical and managerial levels, and data interpretation. |
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