

# Department of Technical Cooperation (TC)

## End-of-Mission Report

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

### 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.

<b>Country</b>	<b>Problem</b>	<b>Information required</b>
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)	- Identification of recharge zones - SW-GW interaction - Groundwater potential
Sri Lanka	Groundwater quality deterioration due to saline water intrusion in Puttalam and Anuradhapura	- Groundwater quality - Source of salinity
	Groundwater sustainability in Sudugala	- Identification of recharge zones -SW-GW interaction -Groundwater potential
Thailand	NO <sub>3</sub> pollution in groundwater	- Identification of NO <sub>3</sub> 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	- Identification of recharge zones -SW-GW interaction - Groundwater potential
	Groundwater contamination from geogenic and anthropogenic sources	- 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,  $\text{NO}_3$ ,  $\text{SO}_4$ ),  $\delta^{24}\text{S}$ ,  $\delta^{13}\text{C}$ ,  $\delta^{15}\text{N}$ ,  $^3\text{H}$ ,  $^3\text{H}$ - $^3\text{He}$  and  $^{14}\text{C}$  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,  $\text{NO}_3$ ,  $\text{SO}_4$ ),  $\delta^{24}\text{S}$ ,  $\delta^{13}\text{C}$ ,  $\delta^{15}\text{N}$ ,  $^3\text{H}$ ,  $^3\text{H}$ - $^3\text{He}$  and  $^{14}\text{C}$  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 Younus, 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:**

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.

- 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:**

- 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.

AGENDA

**IAEA/RCA Executive Meeting on Application of Isotope Techniques to  
Solve Hydrological Problems  
(RAS/8/108)**

Kuala Lumpur, Malaysia  
20-24 April 2009

**Local organizer:**

**Mr. Mohd. Tadza Abd. Rahman**  
Malaysian Nuclear Agency,  
Bangi Complex, 43000 Kajang,  
Selangor Darul Ehsan  
Kuala Lumpur, Malaysia  
Tel.: 0060 3 8925 0510  
Fax: 0060 3 8925 0907  
Email: [Mohd\\_Tadza@nuclearmalaysia.gov.my](mailto: Mohd_Tadza@nuclearmalaysia.gov.my)

**Tentative Agenda**

**Monday – 20 April 2009**

09.00 – 09:30	Registration
09:30 – 10:30	Opening of the meeting Welcome Remarks by Dr. Mohd. Tadza Abd. Rahman, Meeting Coordinator, Malaysian Nuclear Agency Opening remarks by Mr. M.A. Choudhry, Project Lead Country Coordinator Inaugural address by Chief Guest
10.30 – 11:00	<i>Coffee Break</i>
11:00 – 11:30	Adoption of Agenda Election of the Chairperson and Rapporteurs Introduction of Participants
11:30 – 12:30	Overview of the Project – Mr. M.A. Choudhry (Project Lead Country Coordinator)
12:30 – 14:00	<i>Lunch Break</i>

## **Presentations of Country Report**

### **Group 1: Assessment of Groundwater and Surface water Contamination**

14:00 – 14:45	Country Report - Bangladesh
14:45 – 15:30	Country Report - Vietnam
15:30 – 16:00	<i>Coffee Break</i>
16:00 – 16:45	Country Report – Sri-Lanka
16:45 – 17:30	Country Report - China
17:30 – 18:00	Discussion of the country reports

### **Tuesday – 21 April 2009**

#### **Group 2: Assessment of Surface water-Groundwater interactions**

09:00 – 09:45	Country Report - India
09:45 – 10:30	Country Report - Pakistan
10:30 – 11:00	<i>Coffee Break</i>
11:00 – 11:45	Country Report - Myanmar
11:45 – 12:30	Country Report - Indonesia
12:30 – 13:00	Discussions of the country reports
13:00 – 14:30	<i>Lunch Break</i>

#### **Group 3: Management of Groundwater/Surface water resources**

14:30 – 15:15	Country Report - Thailand
15:15 – 16:00	Country Report - Malaysia
16:00 – 16:30	<i>Coffee Break</i>
16:30 – 17:15	Country Report - Korea
17:15 – 18:00	Country Report - Philippines
18:00 – 18:30	Discussion of the country reports

### **Wednesday – 22 April 2009**

09:00 – 10:00	IAEA's Water Resources Programme: Case Studies - Mr. P.K. Aggarwal
10:00 – 11:00	Lecture on 'Basic Principles of Isotope Techniques and Applications' - Mr. M.A. Choudhry
11:00 – 11:30	<i>Coffee break</i>
11:30 – 12:30	Lecture on 'Helium isotope dating for groundwater-surface water assessment' - Mr. P.K. Aggarwal
12:30 – 14:00	<i>Lunch Break</i>

- 14:00 – 15:30 Overview of country reports and discussions of local and regional issues– Mr. M.A. Choudhry
- 15:30 – 16:00 *Coffee Break*
- 16:00 – 17:30 Group discussions on common themes (issues/problems, management actions to address the problems and recommendations to the Governments and to the IAEA)

### **Thursday – 23 April 2009**

- 09:00 – 11:00 Discussion on implementation of projects in the new project cycle RAS8108 (2009 – 2011)
- 11:00 – 11:30 *Coffee break*
- 11:30 – 12:30 Presentations and discussions on the output of Groups
- 12:30 – 14:00 *Lunch Break*
- 14:00 – 15:30 Discussions, working groups; preparation of report
- 15:30 – 16:00 *Coffee Break*
- 15:30 – 17:00 Discussions, working groups; preparation of report

### **Friday – 24 April 2009**

- 09:00 – 11:00 Preparation of the draft meeting report
- 11:00 – 11:30 *Coffee break*
- 11:30 – 12:30 Discussions on the meeting report
- 13:00 – 14:00 *Lunch Break*
- 14:00 – 15:30 Finalization of the draft meeting report
- 15:30 – 16:00 *Coffee Break*
- 16:00 – 16:30 Closing of the meeting

### **Important points:**

- Country reports should highlight status of water resources in the country, issues/problems in water resources development and management, common remedial actions, and adaptation/integration of isotope techniques.
- Participants should bring with them, electronically, all the presentations at the meeting.
- Participants should send a brief summary (one page) of their presentations and pdf of presentation to Mr. P.K. Aggarwal (Email: [P.Aggarwal@iaea.org](mailto:P.Aggarwal@iaea.org)) Ms. Ravina Brizmohun ([R.Brizmohun@iaea.org](mailto:R.Brizmohun@iaea.org)) and Mr. Manzoor Ahmad Choudhry (Email: [manzoorriad@yahoo.com](mailto:manzoorriad@yahoo.com)) at least one week before the meeting.

**RAS8108/9001/01**  
**IAEA/RCA Executive Meeting on Application of Isotope Techniques to Solve**  
**Hydrological Problems**  
**Malaysia, Kuala Lumpur**  
**2009-04-20 - 2009-04-24**

**List of Participants**  
(as of 2009-03-20)

1	<b>IAEA (22-24 April 2009)</b>	Mr Pradeep Kumar Aggarwal International Atomic Energy Agency Department of Nuclear Sciences and Applications Division of Physical and Chemical Sciences Isotope Hydrology Section A2351 VIC  Tel.: 0043 1 2600 21735 Fax: 0043 1 26007 EMail: <a href="mailto:P.Aggarwal@iaea.org">P.Aggarwal@iaea.org</a> Internet: <a href="http://www.iaea.org">http://www.iaea.org</a>
2	<b>Pakistan (Expert)</b>	Mr Manzoor Ahmad Choudhry Division of Isotope Application PINSTECH Pakistan Atomic Energy Commission (PAEC) Lehtrar Road P.O. Box 1482, Nilore ISLAMABAD 45650 PAKISTAN  Tel.: 0092 51 2208038 Fax: 0092 51 2207374 EMail: <a href="mailto:manzoor@pinstech.org.pk">manzoor@pinstech.org.pk</a>
3	<b>Bangladesh</b>	Mr Nasir Ahmed Institute of Nuclear Science and Technology (INST) Atomic Energy Research Establishment (AERE) Bangladesh Atomic Energy Commission (BAEC) Ganakbari, Savar P.O. Box 3787 DHAKA 1000 BANGLADESH Tel.: 00880 2 7790684 Fax: 00880 2 8130102 EMail: <a href="mailto:nasirbaec@hotmail.com">nasirbaec@hotmail.com</a>

4	<b>Bangladesh</b>	Mr Mizanur Rahman Water Resources Planning Division Institute of Water Modelling House No. 476, Road No. 32 Mohakhali DOHS DHAKA 1206 BANGLADESH Tel.: 00880 2 21056225 Fax: 00880 2 8827901 EMail: <a href="mailto:mrm@iwmbd.org">mrm@iwmbd.org</a>
5	<b>China</b>	Mr Zhiming Wang Beijing Research Institute of Uranium Geology China National Nuclear Corp. (CNNC) 10, Xiao-guan-dong-li, Anwai, Chaoyang P.O. Box 9818 BEIJING 100029 CHINA Tel.: 0086 10 64960709 Fax: 0086 10 64917143 EMail: <a href="mailto:zhiming_wang@263.net">zhiming_wang@263.net</a>
6	<b>India</b>	Mr Tirumalesh Keesari Isotope Applications Division (IAD) Bhabha Atomic Research Centre (BARC) Department of Atomic Energy (DAE) Trombay MUMBAI, Maharashtra 400 085 INDIA Tel.: 0091 22 25590177 Fax: 0091 22 25505151 EMail: <a href="mailto:tirumal@barc.gov.in">tirumal@barc.gov.in</a>
7	<b>India</b>	Mr Kavallappa Shivanna Isotope Applications Division (IAD) Bhabha Atomic Research Centre (BARC) Department of Atomic Energy (DAE) Trombay MUMBAI, Maharashtra 400 085 INDIA Tel.: 0091 22 25593859 Fax: 0091 22 25505151 EMail: <a href="mailto:kshivu@barc.ernet.in">kshivu@barc.ernet.in</a>
8	<b>Indonesia</b>	Mr Syamsu Daliend Department of Energy and Mineral Resources Directorate General of Mineral Coal and Geothermal Jl. Prof. Dr. Supomo No.10 12870 JAKARTA INDONESIA

		<p>Tel.: 0062 2183702847  Fax: 0062 2183702847  EMail: <a href="mailto:irvyhidayat@yahoo.com">irvyhidayat@yahoo.com</a></p>
9	<b>Malaysia (Local PAR)</b>	<p>Mr Mohd Tadza Abd. Rahman  Malaysian Nuclear Agency  Bangi  43000 KAJANG, Selangor  MALAYSIA  Tel.: 0060 3 89282972  Fax: 0060 3 8925 0907  EMail: <a href="mailto:Mohd_Tadza@nuclearmalaysia.gov.my">Mohd_Tadza@nuclearmalaysia.gov.my</a></p>
10	<b>Malaysia (Local PAR)</b>	<p>Mr Mohammad Hatta Husin  Artelligent Sdn Bhd  No.35, Jalan USJ21 / 11  UEP Subang Jaya  47600 SUBANG JAYA, Selangor  MALAYSIA  Tel.: 00603 80242533  Fax: 00603 80243422  EMail: <a href="mailto:hatta.husin@gmail.com">hatta.husin@gmail.com</a></p>
11	<b>Malaysia (Local PAR)</b>	<p>Mr Amran Kamaruddin  Zircon Diversified Technologies  Medan Putra Business Center  Suite 31-2-2 Jalan 3 / 62D,  KUALA LUMPUR, Bandar Menjalara  MALAYSIA  Tel.: 00603 62755849  Fax: 00603 62756024  EMail: <a href="mailto:dtzircon@gmail.com">dtzircon@gmail.com</a></p>
12	<b>Myanmar</b>	<p>Ms Thu Zar Lwin Oo  Department of Atomic Energy  Myanmar Scientific and Technological Research Department  (MSTRD)  Ministry of Science and Technology  Building No. 21  NAY PYI TAW  MYANMAR  Tel.: 0095 67 404460  Fax: 0095 67 404461  EMail: <a href="mailto:most18@myanmar.com.mm">most18@myanmar.com.mm</a></p>
13	<b>Pakistan</b>	<p>Mr Allah Bakhsh Sufi  Pakistan Water and Power Development Authority  Egerton Road  Pia Tower, 4th Floor  LAHORE  PAKISTAN</p>

		<p>Tel.: 0092 429202690  Fax: 0092 429202576  EMail: <a href="mailto:drabsufi@yahoo.com">drabsufi@yahoo.com</a></p>
14	<b>Philippines</b>	<p>Mr Francisco Arellano  Maynilad Water Services, INC.  Katipunan Road  Metro Manila  QUEZON CITY  PHILIPPINES  Tel.: 00632 9205408  Fax: 00632 9205408  EMail: <a href="mailto:frankie.arellano@mayniladwater.com.ph">frankie.arellano@mayniladwater.com.ph</a></p>
15	<b>Philippines</b>	<p>Mr Ferdie Billones  National Water Resources Board  8th Floor NIA Bldg. EDSA  1100 QUEZON CITY  PHILIPPINES  Tel.: 0063 2 9202724  Fax: 0063 2 9202724  EMail: <a href="mailto:fibillones2000@yahoo.com">fibillones2000@yahoo.com</a></p>
16	<b>Korea, Republic of</b>	<p>Mr Geon-Young Kim  Korea Atomic Energy Research Institute (KAERI)  1045 Daedeok-daero, Yuseong-gu  P.O. Box 105  DAEJEON 305-353  KOREA, REPUBLIC OF  Tel.: 0082 42 868 8197  Fax: 0082 42 8682064  EMail: <a href="mailto:kimgy@kaeri.re.kr">kimgy@kaeri.re.kr</a></p>
17	<b>Sri Lanka</b>	<p>Mr Galapitagedara R.R. Kuranaratne  Water Resources Board  2A Gregory's Avenue  P.O. Box 34  COLOMBO 07  SRI LANKA  Tel.: 0094 322265208  EMail: <a href="mailto:grrkaru@yahoo.com">grrkaru@yahoo.com</a></p>
18	<b>Sri Lanka</b>	<p>Mr S.K.S.K. Harsha Suriyaarachchi  Water Resources Board  2A Gregory's Avenue  P.O. Box 34  COLOMBO 07  SRI LANKA  Tel.: 0094 112697050  Fax: 0094 112689772  EMail: <a href="mailto:harshasuri@hotmail.com">harshasuri@hotmail.com</a></p>

19	<b>Thailand</b>	Adisai Charuratna Department of Groundwater Resources Ministry of Industry Rama VI Road Ratchathewi BANGKOK 10400 THAILAND Tel.: 0066 2 6602576 Fax: 00662 3543509 EMail: <a href="mailto:adisai54@yahoo.com">adisai54@yahoo.com</a>
20	<b>Thailand</b>	Mr Kriengsak Srisuk Department of Geotechnology Faculty of Technology Khon Kaen University KHON KAEN 40002 THAILAND Tel.: 0066 43 348198 Fax: 0066 43 348198 EMail: <a href="mailto:kriengsk@kku.ac.th">kriengsk@kku.ac.th</a>
21	<b>Vietnam</b>	Mr Kien Chinh Nguyen Department of Isotope Hydrology Centre for Nuclear Techniques 217 Nguyen Trai, Quan 1 HO CHI MINH CITY 70000 VIETNAM Tel.: 0084 8 38356568 Fax: 0084 8 8367361 EMail: <a href="mailto:nkienchinh@gmail.com">nkienchinh@gmail.com</a>
22	<b>Vietnam</b>	Mr Giap Trinh Van Institute for Nuclear Science and Technology Vietnam Atomic Energy Commission (VAEC) Hoang Quoc Viet Street P.O. Box 5T-160 HANOI VIETNAM Tel.: 0084 4 8361433 Fax: 0084 4 8363295 EMail: <a href="mailto:tvgiap@mail.vaec.gov.vn">tvgiap@mail.vaec.gov.vn</a>



الوكالة الدولية للطاقة الذرية  
 国际原子能机构  
 INTERNATIONAL ATOMIC ENERGY AGENCY  
 AGENCE INTERNATIONALE DE L'ÉNERGIE ATOMIQUE  
 МЕЖДУНАРОДНОЕ АГЕНТСТВО ПО АТОМНОЙ ЭНЕРГИИ  
 ORGANISMO INTERNACIONAL DE ENERGÍA ATÓMICA

WAGRAMER STRASSE 5, P.O. BOX 100, A-1400 VIENNA, AUSTRIA  
 TELEPHONE: (+43 1) 2600, FACSIMILE: (+43 1) 26007, TELEX: 112645 ATOM A, E-MAIL:  
 Official.Mail@iaea.org, INTERNET: <http://www.iaea.org>

### Travel Record Form

**Project No.:** BGD/8/020 01 01

**Expert Name:** Manzoor Ahmad CHOUDHRY

**Address:** Isotope Application Division  
Pakistan Institute of Nuclear Science And Technology  
P.O. Nilore, Islamabad, Pakistan

THIS FORM MUST BE COMPLETED AND RETURNED AT THE END OF THE MISSION

ITINERARY PLACE	ARRIVAL			DEPARTURE			TRAVEL MODE Air, Rail Bus, etc.	REMARKS
	DD	MM	YY	DD	MM	YY		
Islamabad				19	04	2009	By Air	
Dubai	19	04	2009	19	04	2009	By Air	
Kuala Lumpur	19	04	2009	25	04	2009	By Air	
Bangkok	25	04	2009	25	04	2009	By Air	
Dubai	25	04	2009	25	04	2009	By Air	
Islamabad	26	04	2009				By Air	

PLEASE ATTACH AIRTICKET OR OTHER TICKET STUBS (rail, bus, ship, etc.) EXPRESS BAGGAGE TICKET/RECIPTS AND ANY OTHER RECEIPTS CONNECTED WITH YOUR TRAVEL

Any private tours and/or stopovers should be indicated in the above itinerary and explained under "Remarks"

**Annex-4**

**Emirates**

NAME OF PASSENGER  
**CHOUDHRY/MANZOORAHMA**

FROM  
**ISB**

TO  
**ZONE B**

FLIGHT **EK 615** CLASS **J** DATE **19APR** TIME **0440**

GATE **0355** BOARDING TIME **0355** SEAT **4D** SMOKE **NO**

PCS **1** WT **22** UNCKD **0225** BAGGAGE ID NUMBER

DOCUMENT NUMBER CPN  
**ETKT 1763599290916-1**

FQTV EK-BLUE-X726

**Emirates**

NAME OF PASSENGER  
**CHOUDHRY/MANZOORAHMA**

FROM  
**DXB**

TO  
**ZONE B**

FLIGHT **EK 342** CLASS **J** DATE **19APR** TIME **1030**

GATE **309** BOARDING TIME **0945** SEAT **4D** SMOKE **NO**

PCS **1** WT **22** UNCKD **0081** BAGGAGE ID NUMBER

DOCUMENT NUMBER CPN  
**ETKT 1763599290917-1**

FQTV EK-BLUE-X726

**business class**  
PAS MASUK / BOARDING PASS

More than just an airline code.  
MH - Malaysian Hospitality

NAMA / NAME  
**CHOUDHRY/MANZOORAHM**

DARI / FROM  
**KUALA LUMPUR**

KE / TO  
**SUVARNABHUMI - INTL**

FLIGHT **MH 788** CLASS **D** DATE **25APR** TIME **1220**

GATE **H04** BOARDING TIME **11:50** SEAT **4D** SMOKE **NO**

XXX  
SEQN: 18  
TKNE2323599290919C1

**malaysia**  
AIRLINES  
malaysiaairlines.com

**THAI** **TRANSFER**  
Boarding Pass

NAME OF PASSENGER / ชื่อ - นามสกุล  
**CHOUDHRY . MANZOORAHMA**

FROM / จาก  
**BANGKOK / BKK**

TO / ไป  
**DUBAI / DXB**

**THAI AIRWAYS INTL.**

FLIGHT / เที่ยวบิน CLASS / ชั้น DATE / วันที่ SEQ NO

**TG 515 C 25APR 142**

GATE / ประตู BOARDING TIME / เวลาขึ้นเครื่อง SEAT / ที่นั่ง SPECIAL MEAL / อาหารพิเศษ

**D7 1440 14B MOML**

BKKA65 TG\*S QH51179

**THAI** **TRANSFER**  
Boarding Pass

NAME OF PASSENGER / ชื่อ - นามสกุล  
**CHOUDHRY . MANZOORAHMA**

FROM / จาก  
**DUBAI / DXB**

TO / ไป  
**ISLAMABAD / ISB**

**EMIRATES AL**

FLIGHT / เที่ยวบิน CLASS / ชั้น DATE / วันที่ SEQ NO

**EK 614 J 25APR 54**

GATE / ประตู BOARDING TIME / เวลาขึ้นเครื่อง SEAT / ที่นั่ง SPECIAL MEAL / อาหารพิเศษ

**2130 5F**

BKKA65 EK 182513726



Addresses of Mr. Mohd Noor Bin Mohd Younus, Chief Guest (Deputy Director General, Malaysian Nuclear Agency) and Mr. Manzoor Choudhry in Inaugural Ceremony



Group photo of the meeting participants with the Chief Guest



Presentation of Project Overview by Manzoor Choudhry



Participants of the meeting during a presentation



A lecture by Mr. Pradeep Aggarwal, Head Isotope Hydrology Section, IAEA



Participants discussing common themes in two groups



Visit of Isotope Hydrology (Mass Spectrometer) Lab. at NMA, Bangi



Group photo of the participants with Mr. Aggarwal at the end of the meeting