INTERNATIONAL ATOMIC ENERGY AGENCY

FINAL PROGRESS REVIEW MEETING

PROJECT RAS/8/091
"Process Diagnostics and Optimization in Petroleum Industry",
and
PROJECT RAS/08/94
"Optimization of Materials in Industry using on-line Bulk Analysis Techniques"

MEETING REPORT

6–10 December 2004
Mumbai, India

1. INTRODUCTION

The IAEA/RCA Projects on "Process Diagnostics and Optimization in Petrochemical Industry" (RAS/8/091) and "Optimization of Materials in Industry using On-line Bulk Analysis" (RAS/8/094) using radiotracers, sealed sources and nucleonic gauges have been promoting applications for industrial process analysis and optimization of materials. The final meeting was organized to review and evaluate the achievements of these projects, and discuss the lessons learned from implementation of these projects. The meeting agenda also included discussions on the strategies for propagating these technologies in all the RCA Member States, strengthening regional cooperation, discussing work plan for 2005–2006 cycle and kick starting the project inputs for 2007–2008 cycle.

2. OPENING OF MEETING

The meeting started on 6 December 2004 at 10.00 hours at the Hotel Quality Inn Parle International in Mumbai, India. Dr. Gursharan Singh, Head of Isotope Applications Division of Bhabha Atomic Research Centre, opened the meeting, and gave brief account of programme details. Dr. K. Raghuraman, RCA National Representative of India, presented a brief description of RCA activities. Dr Joon-Ha Jin, Technical Officer/IAEA, gave an overview of progress achieved in RCA Member States under the projects. Shri. H.S. Kamath, Director of Nuclear Fuels Group, BARC, delivered the inaugural address. He gave a brief overview of the work carried out by India to benefit Indian industry. Shri. A.S. Pendharkar, Head of Tracer Technology Application Section of Isotope Applications Division, BARC, proposed the vote of thanks.

The meeting was attended by 17 participants, which included 12 delegates from RCA Member States, four observers from the host country, and Dr. Joon-Ha Jin, from IAEA (Annex 1). The delegates represented Australia, Bangladesh, China, India, Indonesia, Korea, Malaysia, Myanmar, Mongolia, Philippines, Sri Lanka, and Thailand. Two participants from Pakistan and Vietnam could not attend the meeting.

Dr. Gursharan Singh was elected as chairman of the meeting and Dr. H. J. Pant, as rapporteur. The Agenda of the meeting is given in Annex 2.

3. TECHNICAL DISCUSSIONS

Achievements and lessons learned from implementation of projects RAS/8/091and RAS/8/094 during 2003–2004 in RCA Member States

Each participant presented his/her country report for the year 2003–2004, which highlighted the achievements and lessons learned from implementation of projects RAS/8/091and RAS/8/094 during 2003–2004. The country reports are given in Annex 3. A summary is presented in the table below.

Country	Period covered: 2003–2004
AUSTRALIA	**Achievements:** **RAS/8/094** ➢ Development of Mark 2 upgraded version of Stockpile Probe. ➢ Design and manufacturing of the measuring head and console for the PGNAA Off-belt Analyser as well as harmonious and efficient interaction with Beijing Regional Centre leading to successful manufacturing of mechanical components of Off-belt Analyser and PGNAA logging system by Chinese counterpart. ➢ Commencement of licensing procedure by CSIRO, Exploration and Mining and RCA partners; Hanoi Institute for Nuclear Science and Technology, Vietnam and Shandong Bureau of Coal Geology for production and marketing of Stockpile Probe in Vietnam and China. ➢ Sustained support to Beijing and Hanoi Regional Centres and to RCA Member States through provision of instrumentation, know-how, training and expert assistance. ➢ Inclusion in CSIRO, Exploration and Mining Research Plan the scientific and technological advancements and goals signalled by RCA Member States as priority areas (technology pull). **Lessons learned:** Do not underestimate completion time for delivery.

BANGLADESH	**Achievement:** **RAS/8/091** ➢ Flow rate measurements, gamma column scanning, level/interface measurements established and applied in industry. **Lessons learned:** Awareness in Industry is needed for propagating of radioisotope applications.
CHINA	**Achievements:** **RAS/8/091** ➢ Inter-well Tracer Test (IWTT) technology was further developed and promoted to oil companies in China for routine service. ➢ Column scan technology was upgraded and applied to petrochemical industries as routine service. ➢ The 'Procedure for Radiotracers in Oilfield Inter-Well Tracing Studies' was drafted in 2003. ➢ Petrochina Standard: 'Requirements on Oilfield Inter-well Tracer Test" was drafted 2004 and will be issued in 2005. ➢ Society for Nuclear Techniques in Industry, 2004 ➢ Tomographic gamma scan (Grid scan). **RAS/8/094** ➢ Regional Training and Demonstration Centre on PGNAA was established in CIAE, Beijing in 2004, with the contributions of project fund and the in-kind fund of CIAE. ➢ Two regional events were successfully completed in Beijing: RTC on PGNAA (2004) and REMS on PGNAA (2004). ➢ 10 key personnel were trained through training events and scientific visit of the project. **Lessons learned:** Advanced bulk analysis technology using PGNAA is necessary in China.

INDIA	**Achievements:** **RAS/8/91** ➢ Radiotracer applications were carried out in FCCUs, residence time distribution (RTD) investigations in fluidised bed coal gasifiers, Visbreakers, oxidizers, extractors, mixer-settlers and various pilot-scale systems, leak detection in various heat exchangers, development of tracer injection systems, data acquisition system, pipeline inspection gauge for leak detection. ➢ The sealed source applications include development of technology for gamma scanning of large diameter [>5M] columns, about 30 columns were investigated in last 2 years, automated gamma scanning unit tried and will be operational in 6 months, interface location using neutron backscatter techniques, grid scanning tomography of medium diameter columns and pipeline blockage location. ➢ Following training courses, workshops and meetings were conducted. 1. RW on Process Diagnostics Using Radioisotope Techniques. RW on Tracers in Oil Field Investigations (2003, Mumbai). 2. Final Progress Review Meeting of Projects (RAS/8/91 and RAS/8/94) in 2004 at Mumbai. ➢ Participated in the following IAEA training courses/ meetings: Total of 6 participants were trained. (1) MSM 2004 in Malaysia (2) RTC, 2004 in Korea. **RAS/8/94** ➢ Participated in two training courses conducted in China and Thailand. **Lessons learned:** For technology propagation to the end-users, we should increase the awareness among the decision makers in industry and develop the technology by involving academic institutions, industrial consultants and industrial R&D organizations.
INDONESIA	**RAS/8/091** **Achievement:** Leak detection test in buried pipelines. Gamma scanning technology developed and implemented in various industries. 11 column scanned, automatic column scanner developed. Awareness about potential benefits of tracer technology created in Indonesian chemical and petrochemical industry. **Problems:** Leak & blockage detection in buried pipelines. Identification of old laid underground pipelines. Non-availability of proper tracer injections and metering pump.

KOREA

Achievement:

RAS/8/091

- **Developed** automated radiotracer injection system to minimize Radiation exposure, multi-channel data acquisition system and the automatic column scanner.
- **Supplied** Multi-channel data acquisition system to Vietnam and Pakistan and the automatic column scanner to Thailand and Pakistan under the IAEA support.
- Radiotracer tests were carried out in the wastewater treatment plant for process optimization.
- New attempt to combine the radiotracer technology with the computational fluid dynamic modeling for better understanding of the process unit.
- Many demonstrative experiments using sealed gamma source and radiotracer have been performed to maintain the positive relationship with local petrochemical industry.

Following IAEA/RCA Regional Training Courses and Meetings attended and hosted

- EGM on quality control & accreditation in radioisotope applications in petroleum/chemical industries, OAEP, Bangkok 2003.
- Meeting for Senior Managers on "Benefits and Safety in RI Techniques for Problem Solving in Petroleum/Chemical Industry, 2004.
- One expert mission was undertaken
- Regional RTC on Industrial Process Gamma Tomography (RAS 8/091) was hosted 2004.

RAS/8/094

- Attended the IAEA/RCA Regional training course on PGNAA technology for Bulk on-line analysis and the coordinator meeting (RAS/8/094) 2004. China.

MALAYSIA	**Achievements:** **RAS/8/091** ➢ Routine application of nucleonic gauges, nucleonic control system (NCS), sealed source and radiotracer techniques for Oil & gas, chemical and petrochemical industries. These include gamma column scanning, pipe scanning for blockage detection, level and interface measurement in process vessels and storage tanks, scanning of gigantic storage tank floors, corrosion under insulation measurement of pipeline and vessels, flow-rate measurement, leak detection, RTD studies etc. ➢ For sealed source services (such as gamma column scanning, pipe scanning and neutron application), Malaysia received ISO 9001: 2000 certification for Quality Management System from SIRIM Berhad, Malaysia and UKAS, United Kingdom in 2002, and the process for accreditation of radioisotope application laboratories to ISO 17025 is underway. Malaysia is willing to share this experience to all Member States. ➢ The development of advanced radioisotope technology which include industrial process gamma tomography, advanced robotic system for pipe scanning and modern column scanning system (ColScan Masterpiece) etc is on-going in Malaysia Institute for Nuclear Technology Research (MINT) with a close cooperation with other research centres and universities. MINT and Department of Museum and Antiquities Malaysia (DMA) are in the process of developing a new technique, called Neutron-Induced Prompt Gamma-ray Techniques (NIPGAT) for inspection the degree of deterioration of historic building in Malaysia. ➢ MINT has established an engineering test-bed facility called "Evaluation and Verification Facility (EVF)" for training, testing and verify radioisotope application technology as well NDT techniques. ➢ Malaysia was actively involved in all programme of meeting, group training course, demonstration, workshop etc under both RAS/8/091 and RAS/8/094 projects. Malaysia was given the lead to draft a protocol on "Gamma scanning of industrial process column" during expert group meeting (EGM) in Bangkok, Thailand in 2003. The protocol is now published by the IAEA.

MONGOLIA	**Achievements:** **RAS/8/094** ➢ Portable XRF Analyser with Cd-109 source was applied for Ash content determination in coal samples. Also to establish co relations between ash content and calorific value for various coalmines were determined. Plans to use the coal analyser for coalmines and power stations in future also.
MYANMAR	**Achievements:** **RAS/8/091** Level measurements, radiography, logging in oil fields, radiation safety services. Awareness about potential benefits of the technology, routine services. **Problems:** No reactors and facilities available, lack of sufficient trained manpower, non-existence of National Tracer / Sealed source application group.

PAKISTAN

Achievements:

RAS/8/091

- Industrial Applications in areas of leak detection in heat exchangers & underground pipelines, RTD analysis of industrial units' wear/erosion/corrosion monitoring in oil/gas pipelines by TLA technique, study of the effect of lubricant oil on wear of vehicle engine parts by TLA technique, inter-well tracing for enhanced oil recovery and gamma column scanning have been successfully introduced and implemented in Pakistan.
- Pakistan has very actively participated in the implementation of regional activities (Regional Training Courses, Workshops, Meetings, Seminars, etc.) of the project. The support of IAEA/RCA in this regard has been appreciable & is acknowledged with thanks. Technical know- how & experience gained through these activities has been utilized positively to implement the 'Radioisotope Technology' at end-user level. The capabilities of 'Tracer Group' have been strengthen in terms of manpower training, equipment and streamlining of procedures to carry out field investigations.
- A number of seminars were conducted at national level to promote Radiotracer and Sealed Source Technology to industry. Executive engineers/scientists from various industries and research institutions attended these seminars.
- A number of field demonstrations were arranged in various industries to practically demonstrate the capability of Radioisotope Technology in order to convince the decision makers to employ the technology to their product lines.
- Thin Layer Activation (TLA) Technology was successfully, implemented for corrosion monitoring in oil/gas pipelines and wear monitoring in automobile industry.

RAS/8/094

- Pakistan participated in the regional activities of RAS/8/094 on the level of participation in workshops/training courses/meeting. No equipment was received under these two projects. The technology could not be brought to end-user level in Pakistan because it needs major investment.

Lessons learned:

a) Contacts with industry need to be strengthened in order to further promote 'Radioisotope Technology' in industry
b) New radiotracers need to be developed and validated for high temperature, high pressure organic systems
c) For PGNAA applications in mineral industry, the necessary field equipment (gauges/loggers, neutron sources, software, etc) is not available
d) The PGNAA technology is expensive to acquire from commercial sources
e) The mineral industry (mostly in private sector) is not willing to invest in advanced technology involving high cost and sophisticated equipment.

PHILIPPINES	**Achievements:** **RAS /8/091** ➢ The capability of the National Tracer Group was upgraded by the attendance of some members of the group to trainings and meetings conducted under the projects. ➢ There is a continuing demand for the service on column scanning, the last being done on a Methanol tower in our offshore platform. **RAS/8/094** **Achievements:** ➢ The capability of the national tracer group was upgraded by the attendance of some members of the Group to the meetings. The knowledge gained and meetings would be utilized to propagate the technology (PGNAA) to increase awareness in the Industry.
SRI LANKA	**Achievements:** **RAS /8/091** ➢ Capabilities established for leak detection in underground pipe lines, heat exchanger, Column scanning, sludge level determination and limited development of human resources. **Requirements:** Training courses on use of radiotracers, digital radiography, flow rate measurements on cooling water lines.
THAILAND	**Achievements:** **RAS/8/091** ➢ End users have benefited from the routine implementation on process diagnostics and optimisation. **RAS/8/094** ➢ The coal industry learned the benefit of the PGNAA borehole logging / on belt analysis technology through field demonstration and training. **Requirements:** 1. RTD studies are required in complex systems like FCCU & extractors. More R & D is required for process tomography. 2. The industry is interested to participate in more on belt analysis techniques

VIETNAM	**Achievements:** **RAS/8/091** ➢ Inter-well Tracer Test (IWTT) technology was further developed with 6 tracers for high temperature and fractured reservoir. Residual Oil Saturation was also studied with new tracer development for high temperature (100–150DC) ➢ IWTT was developed to 2 new reservoirs under JVPC and Conoco Philips. ➢ Column investigation by combination of Gamma Scan and Tracer for RTD. ➢ Transferred RTD to the U of Engineering in HCMC. **RAS/8/094** ➢ Regional Training and Demonstration Centre on Nucleonic Gauge was established in Hanoi, Halong in 2003, with the contributions of project fund and the in-kind fund of Coal Mine Company. ➢ Two regional events were successfully completed in Hanoi and Halong: Workshop on Nucleonic Gauge (2002, 2003). ➢ 12 key personnel were trained through training events and scientific visit of the project. **Requirements:** 1. On the job training on gas tracer and Tracer preparation. **2.** Expert mission on RTD and Gas Tracer. **Lessons learned:** Advanced bulk analysis technology using PGNAA and XRFA is necessary in Cement Industry.

3.2 Work plan for Project RAS/8/099, 2005–2006 Cycle

1. AUSTRALIA

Work Plan (Activities)

1. Continuation of research for implementation of PGNAA method and instrumentation to metalliferous and coal mining industry
2. Multi-technique approach for the application of nuclear and non-nuclear techniques for solving environmental tasks (e.g. monitoring of salinity, acid rain drainage, sulfur monitoring)
3. Design, manufacturing and testing of next generation SIROLOG instrumentation,
4. Development of new software for better spectrometric data analysis and verification of the nuclear-based predictions
5. Delivery of instrumentation, training, advice and expert services when required by RCA Member States and approved by IAEA
6. Technical support to Beijing and Hanoi Regional Centres created under RAS/8/089 and RAS/8/094 projects.

Mode of Implementation:

- Activities 1-4 CSIRO research with possible participation of fellows from RCA Member States under IAEA fellowship program,
- Activities 5 & 6 strictly related to IAEA accepted Work Plan for RAS/8/099.

2. BANGLADESH

Work Plan (Activities)

1. Leakage and blockage detection in underground gas, air and water pipeline
2. Calibration of gas flow meter
3. Level and interface measurement
4. NCS and the above activities with the group working in BARC.

Mode of Implementation

- With the assistance of IAEA expert for gas flow meter calibration.

Needs

1. High pressure gas regulator (100 Kg per square cm)
2. 16 channel data acquisition system
3. Expert (two weeks) for gas sector
4. Participation in PGNAA techniques
5. Training on tracer technology and PGNAA for young scientists.

3. CHINA

Work Plan (Activities)

1. Further develop the oilfield IWTT technologies, strengthen the national service network, and enlarge the scale of service and share technology and experiences with the interested RCA MSs.
2. Further develop the gamma ray column scan technology and enlarge the scale of service.
3. Standardize oilfield IWTT and gamma ray column scan in national level.
4. Conduct technology R&D, demonstration and training on industrial bulk analysis using PGNAA.
5. Conduct national events (training, seminars, conferences) on radioisotope technologies for natural resource development and utilization, sponsored by Society for Nuclear Techniques in Industry, CNS, with the involvement of IAEA/RCA.
6. Supply sealed sources, radioactive tracers and interface gauges developed in CIAE; coordinate the supply of equipment made in China, such as detectors, neutron generators as well as some electronics and software.
7. Provide publications and presentations.
8. Host/attend project scheduled activities.

Mode of Implementation

- The planned project activities will be implemented by means of both national work and the IAEA/RCA cooperation project (RAS/8/099).

Need/s

1. Financial support, technical publications and/or experts for two national events:
   a) National Seminar on Radiotracers for Oilfield Management and Characterization, 2005
   b) National Seminar on Radiotracer and Sealed Source Technologies for Industrial Process Troubleshooting and Optimisation, 2006
2. Fellowship training on industrial gamma tomography, one person for six months, 2005.
3. Equipment: basic software for image reconstruction of gamma tomography (2005), 14MeV portable neutron generator (2005).
4. Expert missions on: 1) PGNAA for Beijing Regional Centre, and 2) gamma tomography.

4. INDIA

Work Plan (Activities)

1. Radiotracer investigations in coal gasifiers, FCCU in refineries, trickle-bed reactors, and wastewater treatment plants
2. Production and application of radiotracer for specific applications
3. Development of pipeline gauge for leak detection in underground pipeline
4. Development of multi-channel data acquisition systems for radiotracer application
5. Gamma scanning of large and thick-walled columns
6. Development of fully automated gamma scanning system
7. Grid scanning and hold up measurements in bubble column and packed column
8. Participation in PGNAA activities.

Mode of Implementation:

- By national tracer and sealed source groups
- By collaboration with academic institutions and end-user industrial R&D houses.

Need/s

1. Participation in RCM meeting and training courses.

5. INDONESIA

Work Plan (Activities):

1. Tracer work in various industries for leak detection, RTD, mixing, flow-rate studies and pig method for blockage detection
2. Development of tracer equipment
3. Introduction PGNAA method for cement industry (local seminar).

Mode of implementation

- In service
- Procurement of pulsed liquid injection and metering pump (aid from IAEA)
- Seminar, expert mission and field demo.

Need/s

1. Pulsed liquid injection and metering pump
2. Fellowship on PGNAA(1 staff member).

6. REPUBLIC OF KOREA

Work Plan (Activities)
1. Diagnosis of large scale industrial process with sealed source and radiotracer
2. Optimization of a WWTP process by mean of RTD/CFD combined technology
3. Development of the industrial computational tomography applicable to the petrochemical industry.

Mode of Implementation
- National R&D project funded by the government.
- Technical consultation and assistance from the developed countries for the related hardware design and its field test.

Need/s
1. Expert mission.

7. MALAYSIA

Work Plan (Activities)
1. Research and development on industrial process tomography (nuclear and non-nuclear modality)
2. Strengthening radiotracer activities in process industries, e.g. FCCU studies, CFD modelling, etc
3. Neutron-induced prompt gamma-ray techniques for the investigation of deterioration historic building
4. Development of the second phase of "Evaluation and verification Centre/Facility (EVF) for radioisotope and NDT technologies
5. International Nuclear Conference (INC 2006)
6. Modernization of column scanning facilities (both hardware and software)
7. Upgrading infrastructure (equipment and manpower) fore radiotracer experiment in petroleum and chemical plants.

Mode of Implementation
- MINT will cooperate with other RIs, universities and end-users in Malaysia. Cooperation from other MSs would be very much welcome.

Need/s
1. Supply of wireless BGO detectors and source holder by KAERI
2. Liquid radiotracer injection system developed by KAERI
3. Training in PGNAA and radioisotope techniques for young scientists.

8. MONGOLIA

Work Plan (Activities)
1. Correlation between coal ash and calorific value will be studied for two more coal mines
   - Software for portable XRF analyser will be modified to determine calorific value of coal.
   - Installation of XRF analyser and demonstration.

2. Participation in RAS/8/099 project for the implementation of PGNAA method for coal copper and other mineral mining industry in Mongolia
3. Determination of gold into the ore will be done using NAA.

Mode of Implementation
- Local specialists will implement Items 1 and 2 above.
- Item 3 will be implemented in cooperation with RAS project.

Need/s
1. Equipment from Regional Centre will be needed for demonstration
2. Expert for PGNAA methods for coal, copper and gold mines
3. Equipment for coal, copper study
4. Training in RTC.

9. MYANMAR

Work Plan (Activities)
1. Participation in radiotracer application in mining and mineral processing activities
2. Participation in wastewater treatment process using radiotracer techniques
3. Extension of the radioisotope application in oil and petroleum industries.

Mode of Implementation
- Formation of working group.

Need/s
1. Technology transfer (fellowship training)
2. Expert visit
3. Equipment (including software, if required).

10. PAKISTAN

Work Plan (Activities)
1. Tracer applications in oilfield for enhanced oil recovery to further expand the applications and streamline the methodology of inter-well investigations
2. Further expand the routine radiotracer applications in petroleum, chemical, paper, power generation, automobile industry and wastewater treatment sector
3. Streamline procedures for Gamma Column Scanning, RTD analysis and leakage detection for quality control/quality assurance for accreditation at national level.
4. Coordinate the existing facilities (nuclear reactor and neutron generator) to create PGNAA facilities for material testing and field sample analyses
5. Develop facilities for field applications of PGNAA for coal and metalliferous mining industries through IAEA/RCA support
6. Disseminate information to end-users (industry) for enhanced use of PGNAA technology
7. Upgrade of laboratory/field equipment and manpower training
8. Host regional events (IAEA/RCA).

Mode of Implementation
- Programme implementation by ‘Tracer Group’ at PINSTECH
- Enhanced collaboration with universities/scientific institutions and end-user industry

- Active participation in IAEA/RCA programme in the sector 'Industry'.

Need/s
1. High pressure liquid radiotracer injection system
2. High pressure gas radiotracer injection system
3. Manpower training (on-the job training) in PGNAA/logging probes, software and interpretation of data
4. Upgrading of gamma spectrometry facility
5. Equipment (detectors, software, accessories, etc.)
6. Expert mission.

11. PHILIPPINES

Work Plan (Activities)
1. Studies on thin layer activation technique (TLA) and demonstration to industry
2. Studies on computational fluid dynamics (CFD) and validation by RTD
3. National seminar on PG NAA
4. Service activities column scanning, etc.

Mode of Implementation
- Philippine nuclear research institute and cooperating agencies.

Need/s
1. On the job training on PGNAA
2. Detectors and ratemeters.
2. PGNAA gauge to be leased from Regional Centre.

12. SRILANKA

Work Plan (Activities)
1. Refinery reformer scanning to check for catalyst channelling; difficulties due to high wall thickness, high products temperature
2. Feed heat exchangers leak detection at high temperature and high pressure
3. Underground pipelines leak detection
4. RTC on radiotracer technologies for leak detection and location in underground pipelines and heat exchangers.

Mode of Implementation
- Through expert help provided by IAEA.

Need/s
1. Expert assistance from IAEA
2. Supply of radioisotopes
3. Training on high wall thickness columns/reactor scanning
4. Fellowship on use of radioisotopes in reactor catalyst channelling/scanning for high wall thickness at high temperature.

13. THAILAND

Work Plan (Activities)

1. Further cooperation with industry end-users to exploit radiotracers and sealed sources applications for troubleshooting and process optimization (petrochemical industry)
2. National seminar planned in 2005
3. R&D on mobile detection system and the initiation of process tomography, in cooperation with local universities
4. R&D on belt analysis of coal, in cooperation in the coal mine industry (PGNAA)
5. Strengthening of manpower capability.

Mode of implementation

- Technical service through consultation and field implementation
- TCDC, if possible
- Seminars and Field applications.

Need/s

1. Experts for seminar, one week, 2005
2. Expert for PGNAA on line belt analysis, 2006
3. One week to assist in preparation for the TC project.

14. VIETNAM

Work Plan (Activities)

1. Further develop the oilfield IWTT technologies, improve methodology for high temperature and fractured basement reservoir with the set of 6 radiotracers
2. Continuation of Residual Oil Saturation Study, first field test
3. Transfer IWTT technology to MS Country of interest such as Indonesia, Malaysia, Thailand, Myanmar with the involvement of IAEA/RCA
4. Further develop the RTD application to petroleum/chemical industries.
5. Conducting national events (trainings, seminars, conferences) on radioisotope technologies for natural resource development and utilization with the involvement of IAEA/RCA.

Mode of Implementation

- Technical service through consultation and field implementation. Planned project activities will be implemented by means of national work, IAEA/RCA cooperation project (RAS/8/099) and bilateral cooperation with other MSs.

Needs/:

1. One week expert on RTD for National Seminar sponsored by the University of Engineering in Ho Chi Minh City, 2nd Quarter of 2005 – Dr. Pandit, India.
2. Two week expert on Inter-well Tracer Analysis, 4th Quarter of 2005 – Mr. Wallace Loder, TTII, USA.
3. 1Ci of partitioning tracer for Residual Oil Saturation Study
4. Fellowship training on RTD application – one person for four weeks, 2005
5. Fellowship training on gas tracer – one person for four weeks, 2006.

3.3 Updated work plan for Project RAS/8/099, 2005–2006 Cycle

2005				
Activity	**Proposed starting date**	**Duration**	**Budget (HC) USD**	**Budget (FA) USD**
RTC on radiotracer techniques for leak detection and location in underground pipelines and heat exchangers	(5–9 Dec) SRL	1W	50,000	
Technical Meeting of specialists on new techniques in sealed sources and radiotracer preparation, injection and data logging.	(9–13 May) PAK	1W	40,000	
RTC on application of PGNAA and other nuclear techniques for analysis of bulk materials	(12–16 Sept.) INS	1W	50,000	
2006				
Project Review (2005–2006) and formulation meeting (2007–2008)	Q1 March MYN	1W	51,500	
RTC on industrial process gamma tomography.	Q2 June KOR	1W		51,500
RTC on sealed sources and radiotracer applications in FCCU	Q3 September IND	1W	51,500	
RTC on applications of radioisotope techniques for optimizing exploitation of gas, oil and solid mineral resources.	Q4 October CHN	1W	39, 400	

This work plan is based on the available budget as mentioned above. However, if extra budget is available, the same will be used for procurement of equipment for supply to the MSs on request.

4. ELECTION OF PROJECT LEAD COUNTRY COORDINATOR

For the project RAS/8/099, Malaysia was elected as the Project Lead Country Coordinator, and Australia and China as the Assistant Lead Country Coordinators.

5. STRATEGIES FOR STRENTHENING REGIONAL COOPERATION

The participants discussed in detail the strategies for strengthening regional cooperation, development and transfer of new techniques including quality control and accreditation. After detailed deliberations, it was felt that for the project cycle 2005–2006, due to limited budget available, the best way of transfer/sharing of knowledge about new

techniques would be through provision of experts and scientist exchange programme among the interested MSs.

In addition, efforts should be made to link web sites of individual countries with RCARO Korea and RCA Office in IAEA.

6. INPUTS FOR THE 2007–2008 CYCLE

Dr. Singh and Dr. Jin informed the participants that the RCA office has requested all the National Project Coordinators (NPC) to send the inputs for project formulation under each thematic Sector for 2007–2008 cycles, as per the revised format sent to all NPC. These inputs should reach the RCA office before December 31, 2004 through the National RCA representatives of each country.

In addition, the approved names of NPC and team for the project RAS/8/099 should be sent to the RCA Office as soon as possible.

6.1. Priority areas for 2007–2008

After detailed discussion, the participants agreed on the following areas of work.

A. Intensification of industrial productivity and improving environment using sealed source and radiotracer technology

- Industrial Process Tomography
- Radioisotope Applications in Oil fields, Gas and Mineral Industry
- Certification and Accreditation of Radioisotope practice personnel and laboratory
- Radioisotope Applications in complex flow systems such as FCCU, Coal gasifier
- Validation of CFD model with RTD techniques
- Radioisotope Applications for Industrial environment including waste water and sediment transport.

B. New applications of nucleonic analysis systems in mineral industry

- Human resource development in NAS through existing Regional Demonstration Centres in Hanoi and Beijing
- New applications (Cu ore, cement and environmental control) that become feasible with advanced NAS
- Progression to on-line techniques for coal and metalliferous ores
- Transfer of manufacturing and maintenance technology of NAS to interested members states
- Enhancement of plant efficiency through use of industrial nucleonic gauges.

7. CONCLUSIONS AND RECOMMENDATIONS

In light of the technical discussions held during the meeting, the following recommendations were made:

- The participants expressed satisfaction on the achievements of these projects. Dr. Singh mentioned that achievements under these projects are not uniform as the RCA MSs

consists of developed, developing and under developed. Hence, the infrastructure and knowledge base is different in each MS.

- Most of the MSs expressed that the lesson learned from implementation of these projects are that for technology propagation to the end-users, we should increase the awareness among the decision makers in industry and develop the technology by involving academic institutions, industrial consultants and industrial R & D organisations.
- The participants agreed that cheapest mode of sharing/transfer of new technology between a small number of MSs is by providing short term experts and exchange of scientists among the interested MSs.
- The updated work plan for the project RAS/8/099 for the cycle 2005–2006 is as per the requirements of MSs.
- The initiative taken by MINT, Malaysia toward quality assurance and accreditation of gamma scanning of columns and pipes is appreciable and this example should be followed by other RCA Member States to move forward in this regard. In this respect, Malaysia is more than willing to share its experience and expertise with other MSs.
- The PRM recommends that a Coordinated Research Project (CRP) at RCA level on further development of Radiotracers & sealed source technology should be initiated in near future.
- In order to comply with quality control and accreditation trend, standard devices, tracers, software should be supplied to RCA Member States. Hardware/software components, in particular tracers for gas liquid and solid phase suitable for harsh environment have to be developed further and provided continuously to Member States.
- The PRM recommends that there should be 2 separate projects, one each for NAS and radiotracers and sealed sources for cycle 2007–2008 cycle.
- The PRM agreed that the existing regional centers under the project RAS/8/094, established in 2001 and 2003 are successful and recommends that these should be sustained.
- It is recommended that the activities related to natural resources sector and advanced technology application, should be of long term duration and extended to future projects.

8. CLOSING

The meeting report was discussed and approved. In closing, the participants thanked Dr. Gursharan Singh and his team their excellent organisation of the meeting and warm hospitality.

9. ACKNOWLEDGEMENTS

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Annex 1: List of Participants
Annex 2: Meeting Agenda
Annex 3: Country Reports