AFRA ARCAL RCA

MINUTES OF THE TRIPARTITE MEETING

AFRA / ARCAL / RCA

ROOM V, AUSTRIA CENTRE VIENNA
19 SEPTEMBER 2002
1500 - 1700 H

As of 2002-09-19

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1. INTRODUCTION

The Tripartite Meeting was convened at the VIC on 19 September 2002. The participants included Representatives from AFRA, ARCAL, RCA and concerned staff of IAEA. Invited participants from ARASIA also attended as observers. The list of participants is attached in Annex-1.

The IAEA was represented by Mr. Qian Jihui, DDG-TC, the three Regional Co-ordinators: Mr. M. Maksoudi (AFRA), Ms. M. Zednik (ARCAL) and Mr. C.R. Aleta (RCA) and other Agency Officials.

The main objectives of the meeting were:

- To share experience and information with the aim to promote TCDC modality among the three Agreements;
- To present the achievements/success stories obtained under two successful projects in each Agreement that could be of interest to the others;
- To discuss and agree on proposals for networking among Agreements and proposals for exchange of information and project experience.

The acting Chairperson of RCA, Mr. John Chung, RCA National Co-ordinator of South Korea, made a few remarks and handed over the chair to AFRA Representative, Prof. N. Bendjaballah, AFRA Representative of Algeria, who thanked the Meeting for their confidence in him. He spoke briefly about the benefits that can be derived from such Forum that is supervised and run by Member States from the three regions. He congratulated the Member States of ARASIA on the birth of a new sister Agreement and wished all success to this cooperative arrangement. He also welcomed the invited guests representing ARASIA and expressed the hope that ARASIA will join this Forum. He then invited Mr. Qian, DDG-TC, to address the meeting (See Annex- for Mr. Qian's opening remarks)

During the opening the DDG-TC, in his remarks, reiterated the purpose of the tripartite meeting as a forum for facilitating the exchange of information among the 3 Regional Agreements; it is not a new organisation or mechanism for carrying out an interregional project; it is to exchange information on technology on selected cases and basis for co-operation. The forum should focus on substance, concrete results and good success stories. The DDG-TC cited some examples of TC supported projects, such as SIT which has gained support of ECOSOC and other organisations; the isotope hydrology applications to help developing countries in water resources assessment and applications in nutrition.

The meeting adopted the provisional Agenda (see Annex-3) and agreed on the following Bureau composition: Chairperson: Prof. Dr.N. Bendjaballah, Member, Mr. Munim Awais, Pakistan Atomic Energy Commission, and RCA National Co-ordinator of Pakistan representing RCA, Dr. Kalumbi Shangula, Permanent Secretary-Ministry of Health & Social Services, Namibia National Coordinator for AFRA, and Dr. J. Raul Ortiz Magaña, National Research Institute of Mexico, for ARCAL as Vice-Chairperson.

2. PRESENTATION OF SUCCESSFUL RESULTS ACHIEVED UNDER SELECTED PROJECTS

The successful projects presented by all Three Agreements are as follows:

AFRA
1.) Information Communication Technologies for Learning Training in the Field of Nuclear Science and Technology

2.) Safe Conditioning of Disused Radiation Sources in AFRA and Non-AFRA Member States

ARCAL
1.) "Quality System for the Production of the Irradiation Sterilized Tissue Graft" – RLA/7/009

2.) "Standardization of Nuclear Nephrourology Techniques" RLA/6/037

3.) "Strengthening the Master of Medical Physics Degree" – ARCAL L - RLA/6/041

RCA
1.) Screening of Diabetics – RCA RAS/6/028

2.) "LDR and HDR Brachytherapy in treating Cervical Cancer" RAS/6/035

The main results of the above projects are summarized in Annex-6(a); 6(b) and 6(c).

In the case of RCA, the establishment of a RCA regional office in Seoul, Korea during the first quarter of 2002 for an interim period of two years is considered as a major achievement amongst the RCA Member States.

During the discussion several comments and proposals were made by the participants to benefit from these success stories. Major proposals are:

- RCA representative requested ARCAL an English version of the handbook on Standardisation of Nuclear Nephrourology Techniques.
- AFRA representative requested if the curriculum of the MSc in medical physics is available. Unfortunately the existing version is only in Spanish version.
- RCA requested the developed ICT material by AFRA. This will be transferred to all Agreements once the material is finalised.

3. NETWORKING AMONG AGREEMENTS. REPORT ON PERIODICAL CONSULTATIONS. PROPOSALS FOR EXCHANGE OF INFORMATION AND PROJECT EXPERIENCE

Net working activities among Agreements were reviewed by the participating countries. There has been exchange of harmonised material experts and protocols between the three Agreements, particularly in the health sector. Moreover, joint meetings were attended by

scientists from the three regions at the initiatives of the three Agreements. Representatives from RCA recommended that a mechanism should be put in place to materialise this exchange of information and experience that take place during the tripartite forum. Representatives form both AFRA and ARCAL think that the mechanism is really in place and up to delegate from the three agreements to take good opportunities and ideas to their own region for use.
In conclusion the Meeting appealed to each member to be alert to innovation that occur in any region and to make the necessary effort to bring this to real end users in their own regions. The chairperson gave the floor to the Representative of ARASIA who thanked the tripartite forum to extend the invitation to them and commend the 3 Agreements for good achievements exchanged during the Meeting. He also expressed the hope that ARASIA takes active role in such gathering and requested assistance from the forum along this line. Finally he requested whether ARASIA can be a member of the tripartite forum. The Chairperson requested comments from the three Agreements on this particular issue. The three Agreements have unanimously welcomed the proposal. The new name of the forum will therefore be Quadpartite.

4.NEXT TRIPARTITE(Quadpartite) MEETING

The Meeting agreed that next Quadpartite takes place at the time of the General Conference in September 2003 .The Agenda of that meeting will follow the format of the present meeting

5. RECOMMENDATIONS

The Meeting discussed and agreed on the following recommendations:

- Success stories selected by the tripartite forum should be compiled in a document and circulated to National Nuclear Institutions and related web sites through the office of each Agreement. This task will be performed by the Agreement, which has the chair of the year.
- Following the approval of the tripartite forum to include ARASIA the Agency is to facilitate the effective participation of this new Agreement.
- As for the sharing of success stories amongst the three Regional Agreements, suggestions were made on the possibility of assessing the best stories amongst the good stories presented by AFRA/ARCAL/RCA. There was also a suggestion to exchange information on thematic areas, which can be decided later.

6. CLOSING

The Chairperson thanked the representatives of three Agreements and ARASIA for their participation in and contribution to this meeting.

ANNEX-1

LIST OF PARTICIPANTS TO THE TRIPARTITE FORUM AFRA, ARCAL, RCA

19 SEPTEMBER 2002
VIENNA, AUSTRIA

AFRA

ALGERIA:	Mr. Messaoud Baalioumer
EGYPT:	Ms. Laila Fikri
NAMIBIA:	Dr. Kalumbi Shangula (Chairperson)
MADAGASCAR:	Dr. Wilfrid Rosofoarisona Ms. Raoelina Andriambololona
SOUTH AFRICA:	Dr. Vuvu Msutwana Qupe
SUDAN:	Dr. Omer El-Amin

ARCAL

MEXICO:	Guillermo Duque
PERU:	Modesta Montoya
CUBA:	Angelina Díaz García Wenceslao Carrera Doral

RCA

AUSTRALIA:	Dr. John Rolland
BANGLADESH:	Prof. Dr. Naiyyum Choudhury
PAKISTAN:	M. Munim Awais
KOREA (Rep. of):	Dr. John K. Chung
MALAYSIA:	Dr. Nahrul Khair Alang Md. Rashid

ARASIA

SYRIA:	Ibrahim Othman
YEMEN:	Mahfoudh Serhan Abdullah

IAEA Officials & Staff present

1. Mr. QIAN Jihui – DDG-TC
2. Mr. B-K Kim – DIR-TCPA
3. Mr. Paulo M.C.Barretto – DIR-TCPB
4. Mr. Mokdad Maksoudi – AFRA Co-ordinator
5. Ms. Maria Zednik – ARCAL Co-ordinator
6. Mr. C.R. Aleta –RCA Co-ordinator
7. Mr. Shamin Chaudhri, – TCPB - TCWAS

RCA Office support staff

8. Ms. Mary Tan- TCPA
9. Ms. Concepcion Segura
10. Ms. Gloria Garcia Ramos

ANNEX-2

TRIPARTITE AFRA/ARCAL/RCA MEETING

19 SEPTEMBER 2002
VIENNA, AUSTRIA

1) Participation:

- Maximum of 15 national representatives (maximum 5 from each Agreement)
- Agency representatives: DG, DDG-TC, DIRs of Div A, B and C

2) Significance of the 2002 tripartite meeting:

- Second occasion for RCA to celebrate its anniversary—its 30th; in 1997 it also celebrated the 25th anniversary
- 6th meeting since 1997 among the Regional Agreements

3) Chairmanship:

- RCA will be interim chair; AFRA will take over.

4) Items to be taken up in the agenda:

- Distribution of materials on the progress of projects agreed to be implemented earlier: (with no discussion)
  - **Development of selected ICT-based training /learning materials in the field of maintenance and repair of nuclear instruments/dam safety**
  - **(a) Establishing quality system in veterinary testing diagnosis laboratory; (b) geothermal energy; and (c) standards and methods for the production of safe radiation sterilized tissue allografts**
  - **(a) Interconnection of Websites; (b) DAT in nuclear medicine and (c) distance learning in applied sciences in radiation oncology.**

- Share achievements obtained under two selected projects/stories in each agreement (and /or region) that could be of interest to others, with emphasis on health sector.

Tripartite AFRA/ARCAL/RCA Meeting

19 September 2002, Vienna, Austria
Vienna International Center (C07V)
1500-1700H

Provisional Agenda

1500 H	1)	Opening remarks by chairperson: RCA Representative. Hand over to new chairperson, AFRA
1515H	2)	Remarks by the DDG-TC
1530H	3)	Designation of the bureau of the meeting by the new chairpersons: AFRA representative ➢ Two vice chairpersons: ARCAL and RCA ➢ Rapporteur: AFRA ➢ Introduction of the participants ➢ Adoption of the agenda
1545H	4)	Presentation by the representatives of the Agreements on transfer of technologies: ➢ Review of achievements during the previous year, for promotion of TCDC among Agreements; ***** ➢ Presentation of successful projects/stories maximum of 2 implemented in each region that could be of interest to others with emphasis on health sector.
1630H	5)	Networking among agreements. Report on periodical consultations. Proposals for exchange of information and project experience; other matters.
1650H	6)	Adoption of major recommendations of the meeting.
1700H	7)	Closing

* - Copies to the distributed

Discussion points for DDG-TC:

"The three regional cooperative agreements (AFRA, ARCAL and RCA) are unique in the UN system and offer us a special opportunity to use our imagination and initiative to structure and carry out programmes uninfluenced by other models or the preconceived ideas of other Agencies." -Mr. J. Qian, 24th RCA GC, 20 September 1995)

1. The DDG-TC may wish to comment on the TC programme for 2003/2004, such as on the quality of the programme among the three agreements (or the TC programme as a whole) and guidance for future programme.

2. Many initiatives of the Regional agreements have been incorporated in the updated TC strategy (such as sustainability and self-reliance, building capable national nuclear institutions, good management practices and income generation). Regional agreements can therefore play a key role in the promotion of these principles and initiatives that will guide the Agency effort in technical assistance;

3. The sustainability of National Nuclear Institutions is placed high on the Agency priority list. Regional Agreements should be the driving engine at regional level for sensitizing MSs about the need to promote sustainability.

4. Regional Agreements can also promote ways and means for preserving nuclear knowledge at national and regional levels.

5. Human resources development such as through regional training courses/ workshops and expert missions are generally built into regional projects; and regional projects support activities at the national level that would be aligned towards this end.

6. Future direction of the tripartite meeting. The tripartite meeting should continue to be a forum for exchanging good stories, for learning about the successes from the other regions that may be useful or adopted in their own regions, and a vehicle for expanding networking among regions on similar needs or technologies.

To refresh on the background:

The nature of the tripartite AFRA/ARCAL/RCA meeting has been the following:

- initiated by Agency in 1996(July and September) and since 1997, AFRA, ARCAL and RCA with support by the IAEA, have been holding this during the GC every year.

-a forum for facilitating exchange of information among the 3 regional agreements;

-not a new organization or mechanism for carrying out interregional projects(will use existing mechanism under national or regional TC projects);INT0/060 is currently the vehicle for promoting TCDC among the Agreements and doing joint enterprises, as well as to facilitate the exchange of experience among the three Agreements

. -limited budget support by IAEA secretariat to facilitate in-depth exchange of technical information(Final results and impact can be obtained only through follow up regional or national projects);

-focuses on substance with practical experience and concrete results--good success stories.

Note: In the tripartite meeting held in July 1996 several recommendations were made and the first one was for the IAEA to allocate specific additional funding for TCDC activities within Regional Agreements. In response to this the IAEA has provided funds under INT0/060.

(AFRA)

TRIPARTITE FORUM MEETING, SEPTEMBER 2002

I. PROGRESS ACHIEVED BY AFRA IN THE FIELD OF INFORMATION COMMUNICATION TECHNOLOGIES (ICTs)

BACKGROUND

The emergence of information and communication technologies (ICTs) is central to current global social and economic transformations. Information technology is now developing a "new economy" which begs the question: "How do we educate and develop our human resources to operate in a social learning cycle that involves abstraction, diffusion, absorption and the impact of knowledge".

Information technology allows exploitation of the latest technologies to achieve new goals, including **education at our own pace**. It fosters innovations, enhances the capacity to understand and act and can reduce costs. Information technology has the potential to save time - a valuable resource, as well as save on financial resources in the case of educational programmes directed towards rural or remote areas in developing countries.

There has been a tremendous growth in the ICT market with multiple ICTs vendors and service providers being available in developing countries, despite the lack of basic infrastructural necessities such as electricity and telephone lines, in many places. This situation is particularly valid in the case of Africa, which is less equipped to face the challenge of globalization and the information age. The information technology revolution and its unprecedented capabilities to process, store, refine and disseminate data, information and knowledge across borders, has dramatically changed the ways in which Governments and the public and private sectors operate world-wide. Most African countries have, to some extent, embraced the ICT revolution, though the ability to effectively harness the technology varies from country to another. To ensure success of ICT projects, it is vital that all infrastructural needs, as well as the commitment of the recipient countries, are secured to sustain this technology.

The major thrust of the Agency's technology transfer programmes towards developing countries is to promote the application of useful nuclear technologies in key areas of national/regional significance to meet priority development needs with special emphasis on food security, human health, water resource management and nuclear instrumentation. The Agency's conventional form of educational/training through fellowships or group training suffers from a number of restrictions (e.g. limited access, cost-effectiveness, language and/or cultural barriers, etc.). Moreover, group training is not generally capable of addressing individual needs, or responding to varying levels of preparation/comprehension, pace and ability. On the other hand, the tremendous developments that have taken place in information and communication technologies over the last few years, are having a profound impact on all sectors of society. As a result, new learning methods, formats and resources are being developed. Among these, ICTs offer mass customization as technology allows individual differences in the goals, learning styles and abilities

of the trainees, to be accommodated while providing immediate feedback on progress made and results achieved. Thus this enhances productivity and has a positive impact on national developmental needs and programmes. To this end, the Agency has taken some active steps for the incorporation of ICTs materials and multimedia tools for training. In order for this effort to have a sustainable impact, the development of ICT-based training/educational material should focus on a number of key nuclear technologies believed necessary for meeting priority development needs. For example, the Agency has developed through the RCA programme some distance learning materials on tissue banking, radiation protection and nuclear medicine.
As far as the extent of availability of ICTs at national level is concerned, only a few attempts were made by some countries to introduce selected applications, at the level of universities and training institutions, in collaboration with NGOs and/or UN agencies. The most challenging issue remains the reliability of infrastructural necessities (electricity and telecommunication lines) as well as the economic viability of the selected ICTs.

DEVELOPMENT OF ICT-BASED TRAINING LEARNING MATERIALS

Through the regional project RAF/0/013 (ICT-base Training to Strengthen LDC Capacity) and INT/0/078 both initiated in 2000, for three years, the Agency proceeded with the development of ICT materials in an exploratory manner to examine the technical feasibility and economic viability of ICT tools and methodologies, in selected LDCs.

The development of ICT-based training/learning material proceeded along three levels of varying complexity, chosen for optimal implementation and cost-effectiveness. Level A involved the use of existing resources and ICT-enhanced material. Level B introduced some modifications/adaptations to existing ICT-based material for local environment, technology, or problem area. Level C relied on complete authoring and production in fields where no suitable ICT-based material was available. The selected material was developed in a variety of forms depending on the selected mode of delivery (e.g., CD-ROMs, video tapes, web-based, etc.).
To minimize costs, ICT-based training material was structured around freely available software for the client side of the training. All software required for the full use of the training materials was contained on the CD where possible.
To attain overall success, a team-based approach to ICT-enhanced training material development was adopted.
In order to promote flexibility, a high degree of modularity was promoted. For each project component, effort was made to partition the ICT-assisted material into self-contained sub-modules for insertion later into packages.
It might be advantageous to explore the feasibility of using some of the regional satellites currently in orbit (e.g., NileSat, WorldSpace), or due to be launched in the near future, as the adopted means for the development and/or delivery of the learning/training material.

DEVELOPED ICT MATERIALS FOR TRAINING IN TROUBLESHOOTING.

The ICT materials have been mainly developed under the project INT/0/078, while the regional project dealt with the development of materials for other nuclear fields. The development was performed by selected experts in the field of maintenance including academics and retired lecturers.

The approach adopted by TC for developing the selected ICT materials was direct contracts with each individual expert in his field. This approach proved to be very efficient as well as cost-effective. On average, the cost per module developed was about $ 5000.
The duration of development varied from a case to another and was around 4 months. The following CD-ROMs were developed:
1. ICT training package for MCAs including training kit and animation, by Mr D. Ponikvar; Slovania
2. Development of an ICT package for LSCs including operation, maintenance and troubleshooting; by Mr G. Govandarajan; India
3. ICT package for TLD readers including animation, by Ms O. Lemus (Cuba) and Mr P. Becker (Brazil)
4. ICT training module for analog electronics, including 40 animation and self-assessment options, by Prof. G. Pahor (Slovania);
5. ICT training package for troubleshooting selected amplifiers and pre-amplifiers including animations and self-assessment options, by Dr R. Krasowski (Poland);
6. ICT package for training on radiation sources and radiation interactions including animations and self-assessment options, by Dr Clikeman;(USA)
7. ICT package on theory and operation of gas detectors including self-assessment options, by Dr Clikeman (USA);
8. ICT package for training in digital electronics including animations and self-assessment options, by Dr D Ponikvar (Slovania);
9. ICT package for training troubleshooting of survey meters including animations and self-assessment options, by Mr D.Barak (Israel);
10. ICT package for training on linear power supplies including animations and self-assessment, by Mr Burr (USA)
The developed materials have been sent to 8 selected trainers in the five regions to test them and to report on any deficiency or improvements that may be required. The final review of the materials will be performed in the Argonne National Laboratory, USA, in October 2002 in the presence of the developers, the trainers as well as some selected trainees. Once the final versions are ready, the materials will be duplicated and provided to selected countries for its routine use.
A coordination meeting of this interregional project is foreseen in Brazil in November 2002 during which future activities of this project will be discussed and updated to reflect the real needs of Member States in the fields.
For an effective use of the developed ICT materials, there must be sufficient trained trainers, adequate laboratory facilities where ICT materials can be used and a demand for such training/learning in the field. Therefore particular efforts were deployed under the regional project to establish ICT Tele-centres.

ESTABLISHMENT OF TELE-CENTRES

a) **Definition of Tele-Centres**

In the context of this pilot demonstration the ICT tele-centre can be defined as an established institution able to:
1. Provide training/learning services to national personnel in selected fields of expertise;
2. Provide advisory assistance to competent authorities, in the field of education/training, through ICT tools and methodologies;
3.Develop/improve ICT training/learning materials where required; and

4. Facilitate the dissemination of information, experience and knowledge in the field of ICT.
In an effort to upgrade the institutional infrastructure, the ICT training tele-centres were located at the Atomic Energy Commissions or directly at end-user institutions (hospitals, veterinary laboratories, artificial insemination centres, etc.).

b) **Objectives of Tele-Centres**

The following overall objectives are identified as the major reasons for the existence of tele-centres:

- To provide training/learning services in the field of expertise, using conventional as well as ICT tools and methodologies.
- To provide advisory assistance to the competent authorities in the use of ICT tools including technical backstopping in terms of hardware and software.
- To develop/modify/improve ICT materials for training national personnel.
- To promote the introduction of ICT tools and training methodologies at national level and to disseminate innovative and improved training methodologies.
- To enhance and foster national training capability in the field of expertise so as to help attains self-reliance.

c) **Criteria for establishing Tele-centres**

The criteria applicable to establishment of Tele-centres are:

- Demonstrated continuous demand for training nationals in the field of expertise,
- Firm commitment of the recipient institute in the Member State to operate, maintain and extend if necessary the Tele-centre including the provision of adequate trainers, premises and overheads for ensuring sustainability after completion of the project,
- Ability to provide training/learning services at reasonable cost as well as leadership in the field of Information Communication Technology, and
- Availability of logistics, communication facilities as well as capacity to rapidly mobilize trainers and resources.

So far, **7 ICT Tele-centres** have been established in Ethiopia, Sudan, Tanzania and Uganda to train various categories of personnel in maintenance, monitoring of trypanosomiasis and artificial insemination.

II. PROGRESS ACHIEVED BY AFRA IN DAM SAFETY

II.1 Current Utilization of Tracer Methods In Dam Engineering

The application of conventional and nuclear techniques presents a number of opportunities over the entire life cycle of a dam project. However, the most opportunities for application for dam safety appear to be the following stages:
- Site investigation
- Monitoring and surveillance during and after the first filling
- Dam safety evaluation

Some major understandings gained as a result of the workshop relative to these applications included the following:

- Failure mode identification is a key aspect in the evaluation of dam safety and application of risk assessment. It was clearly evident that data from tracer techniques could be used to enhance the understanding of failure modes through identification of water flow paths.
- Tracer techniques used in monitoring and surveillance seepage flows provide the potential to enhance the detection of a potential dam safety problem due to their ability to identify changes and specific isotopes in the water flow. This ability could also enhance emergency preparedness by allowing earlier warning of a concern.
- The potential applications of conventional and nuclear techniques are not totally unknown to the engineering community rather the application has been isolated, implemented only on the rare occasions where someone associated with the project happened to be acquainted with the methodology. Thus it appears that tracer techniques were not applied in the past largely because of lack of consideration and awareness of what tracer techniques offer rather than because of lack of applicability.

II.2 Example of tracer applications to dam safety Investigations

II.2.1 Enhancement of Permeability Data In Dam Foundations

Permeability and flow tests can be performed with different tracers, with some advantages compared to the conventional geotechnical tests. These tests are complemented by the single-well tracer techniques, which provide information on the types and magnitude of flow(s) existing in each borehole. Point dilution tests are used to quantify vertical flows. Tracers allow more precision than that achieved by current methods and in some cases the potential for piping or material erosion through the critical deposits may be able to be evaluated as a result of using tracer techniques.

Also subsequent to construction the tracer investigation set up can be used to examine the effectiveness of control measures (grouting, drainage, blankets, etc.)

II.2.2 Origin (genesis) of Water at Leakage Point – Seepage Source Location if Needed

One of the greatest potential uses of tracer techniques in dam leakage studies is the investigation of the origin (genesis) of the water emerging at the leakage point(s). In many instances, more than one type of water could be contributing to the flow at a seepage location at the dam toe [dam leakage, groundwater derived from local recharge, deep (thermal) waters, etc.] The precise nature of the emerging waters, and their mixing proportions, can be precisely determined at each discharge point by sampling and then comparing the sample's natural isotope concentrations to the isotope concentrations of the potential seepage sources (reservoir, rainwater, spring water, etc.). Values of the different physical, chemical and isotope parameters permit the identification and quantification of the water flows not related to the reservoir. Similarly, temperature, conductivity, stable isotopes of waters, etc identify preferential flow paths of waters directly related to the reservoir.

Dye tracers (rodamine WT and uranine) and radioactive (131I, 82Br) have been used. Absorbable tracers (198Au, 46Sc) have been successfully applied to locate the entry of water.

II.2.3 Exact Path of The Leakage

In the case of earth dams where boreholes have been drilled or with possibilities to drill, it is possible to trace the exact flow-path from the infiltration area to the leakage point. Temperature and electrical conductivity profiles in the existing boreholes permit distinguishing water actively flowing in the system, from stagnant or locally derived groundwater. Mapping of the distribution of the flowing waters helps tracking the flow path along the dam body. This technique is extremely helpful in the case of complex flow patterns, controlled by a complex lithology in the abutments when flow is controlled by engineering structures with some deficiencies such as, grouting curtainsand concrete walls. From a dam safety failure mode evaluation perspective consider a case where a dam is founded on alluvium overlying jointed rock. This method could allow determining whether an exiting seepage flow path is through the dam, through the alluvial foundation or only through jointed rock. Such knowledge may allow discerning whether or not a significant failure mode exists.

II.2.4 Quantification of Undetected Leakage

In some instance, loss of reservoir water may not be observable and measurable by conventional gauges or weirs. Leakage water may pass from the dam into the foundation and be mixed with groundwater, thus preventing its measurement with conventional methods. Such seepage can be quantified if a borehole is available in the dam for the injection of a tracer and measuring of the flow-rate. In this case, an artificial tracer is injected in the borehole, and the breakthrough curve is determined at the discharge point. The larger flow-rate determined by the tracer dilution methods allow one to quantification the subsurface flow not accounted at the visible leakage point.

II.2.5 Evaluation of Conduit Seepage

The outlets in earth-fill dams often consist of a metal pipe installed through the dam body. Sometimes mass or reinforced concrete covers these pipes. These structures are one of the most vulnerable aspects with respect to failure for the following reasons:

- During the construction, it is difficult to get the required density of the material in contact with the pipe, facilitating the leakage along the areas close to the pipes.

- Stress bridging may result in a zone of low stress along the sides of the conduit and allow hydro-fracturing and subsequent piping to occur upon filling of the reservoir.
- Dams are foreseen for 100 or more years of operation while metallic pipes have a life span of 20-30 years depending on site. After this period, the pipes deteriorate and fail resulting in leakage from the pipe into the fill and loss of use of the outlet pipe.
- Many dams do not have filter protection along the flow path to protect this zone from piping development. In those cases, when leakage from or through the pipe occurs downstream of the dam it is necessary to define the source of the emerging water, either through the dam or from the leakage developed in the pipe. In such cases, application of tracer techniques could be useful. The tracer could be injected alternatively in the reservoir and in the pipe. Sampling and testing for the tracer in the downstream leakage will help in identifying the source. This will allow the best solution for dam rehabilitation.

II.3 Other nuclear and isotope tracer techniques to be applied in

dam/reservoir management

II.3.1 Sediment management

A sedimentological balance study is a fundamental tool used in reservoir management. Sediment management related to reservoir accretion studies and also to possible reservoir dredging works can profit from the use of tracer techniques. At potential erosion sites, in the reservoir basin, tracers can be used in controlled erosion study experiments by labelling small amounts of sediment in the soil surface. Within the reservoir, the quantification of the accretion, in terms of mass of deposited sediment, can be improved using transmission or back-scattering nuclear probes to determine the vertical density gradients in the dam region where the fine sediment is preferentially deposited. The knowledge of the vertical density profile of fine sediment at the dam face could allow better quantification of the pressure distribution against the dam. This information would provide valuable input to the dam safety assessment. Existing natural tracers such as 210Pb and 137 Cs measured in core samples taken within the reservoir are used to quantify the rate of accretion. Also mineral and element components of bottom sediments together with the geological and lithological knowledge of the upstream region are used to track its origin. Last, but not least, environmentally friendly tracers (e.g. Technetium – 99mTc) broadly used in Nuclear Medicine, can now be applied to label fine sediment. This technique allows behaviour studies of the sediment dynamics and to calculate the environmental impact of dumping sediments in the river downstream of the dam.
In some cases the information gathered with these studies, can save a lot of money that would be spent on boosters, pipelines and dumping areas inland.

II.3.2 Use of Nuclear Techniques for Identification of Changes in Density Material Properties

Tracer techniques can be used for identification of physio-mechanical characteristics of the soils during the construction and for monitoring any change during operation.
Methods for measuring geotechnical properties include the gamma-gamma technique and neutron moisture gauge. Tracer technique allows rapid determination the density and moisture content of soils on the site. Traditional laboratory testing methods do not evaluate the entire soil column and will require more time.

II.4. Achievements attained under the AFRA project

Through intensive training and case studies provided to African hydrogeologists, the above-mentioned techniques are being used routinely in the conceptual design, construction, commissioning and exploitation/maintenance of dams and artificial reservoirs in 14 AFRA Member states. Other countries are still in the training stage. Moreover, at least three Consultant companies specialized in the design and construction of dams have now introduce isotope hydrology techniques in their routine investigations.
One of these companies is providing a Specialized Team in dam leakage and safety to assist the other AFRA countries.

The most important achievements are:

- Each country has now a well trained team that can use routinely these techniques in all phases of dam design, construction, management and maintenance;

- Isotope hydrology techniques have been recognized at the regional level at an efficient and cost-effective tool to complement conventional methods;
- Private companies recognized and introduced these techniques in the services offered to AFRA countries; and
- Increased awareness about the importance of all safety matters related to dams and reservoirs.

This programme will continue in 2003 to help the other countries introduce these techniques and to sustain the regional momentum in the field.

ANNEX-4(b)

(RCA)

Progress on the Technology Transfers among Agreements

The following technologies from RCA were agreed to be exchanged and implemented among the 3 Regional Agreements: distance assisted training for nuclear medicine technologists; distance learning in radiation oncology; tissue banking. RCA was also to assist the other regions on the development of their respective websites.

1. Distance learning in Nuclear Medicine

The training materials include 21 subjects and the full course occupies about 500 hours, requiring 4-5 hours study per week over two years. Modules 1-7 are basic while modules 8-12 are advanced. Ongoing refinement of learning materials and addition of links to references and movie files will further enhance the website and CD versions of teaching materials.

In RCA there are 9 countries involved (Bangladesh, China, India, Korea Malaysia, Pakistan, Philippines, Sri Lank and Thailand), 281 students and at least 114 nuclear medicine departments involved. The materials have been translated into Chinese and Korean (partly).

In the Latin America region the DAT materials have been translated into Spanish and Portuguese and the programme is coordinated through Uruguay involving 92 students in 12 countries. During a workshop of Coordinators and Supervisors in Costa Rica in February 2002 the participants were introduced to "Workshop Tools" and "Assessmen
now in a position to conduct their own country workshops and prepare for assessments while understanding the need to maintain standards as outlined in the guidelines. Two expert missions were supported and one more will be carry out in October this year. A meeting of the supervisors of the course will be held in Santiago, Chile in October this year to review the implementation of the agreements reached in their meeting in Costa Rica.

In AFRA the project is coordinated through South Africa and the DAT materials are being translated into French for use in North African countries. A pilot study has 13 students in 2 countries where students have been assessed at basic level and some are continuing to the advanced level. The students completed successfully the study and have been given certificates. A planning meeting is foreseen in April 2004 to design the workplan and activities for the expansion of DAT to all interested countries.

2. Distance learning in radiation oncology

The modules are currently under development under an RCA project, RAS 6033, involving a subcontractor. The materials are expected to be delivered by end of December 2002 but delays had been encountered in the preparation of materials and the new date of delivery is mid–2003. The pilot study involving selected countries from AFRA, ARCAL and RCA will take place afterwards.

In RCA the 3 countries selected for pilot testing are Malaysia, Pakistan and Philippines. In AFRA and ARCAL the countries for the trial are still to be decided.

3. Interconnection of AFRA, ARCAL, and RCA Websites. Each agreement has now its own regional homepage. National homepages are still under development in most countries. Both the websites of ARCAL (http://arc/cnea.gov.ar/) and RCA (http://www.rca.iaea.org) have links to the Agency'sTC Department homepage.

4. Harmonization of standards and methods for production of safe radiation sterilized tissue graft. The activities under this technology transfer carried out during 2001 included the development of a code of practice for radiation sterilization of tissue allografts, the development of international standards for tissue banks and the development of public awareness strategies for tissue banks. These activities were initially implemented under the framework of INT 0/060, but since 2002 have now been continued under a new project, INT 6052. Additionally, the distance learning course on tissue banking, which has been developed and implemented by the Agency in cooperation with the National University of Singapore under the RCA programme, has been gradually converted to web-based teaching under said INT project. The training courses initiated in 2002 under the INT/6/052 have participation of Asia, Africa, Latin America and Europe trainees, and the materials have been translated into Spanish. An international training centre for tissue bank operator have been established in Singapore after the signature of a MOU between the National University of Singapore and the IAEA and a regional training centre for the Latin America region will be established this year. A MOU with the Musculo-skeletal Transplant Foundation in the USA was signed this year to train Medical Doctors and Transplant Coordinators in the USA. A discussion with the Transplant Services Foundation in Spain is under way to train next year Transplant Coordinators for the Latin America region under INT/6/052.

A Steering and a Technical Advisory Committee have been established to guide the activities of this programme.

(ARCAL)

The following technologies were to be transferred from ARCAL to the other agreements.

1. Geothermics. The Project Coordinators meeting included in the plan for 2002 was held in March in Nairobi, Kenya. An interregional training course will be implemented in October or November for participating countries in management of geothermal reservoirs. Expert missions were carried out to assist interested countries in different topics related with the use of geothermal reservoirs.

2. Establishment of Quality System in Veterinary Testing Diagnosis Laboratory. A quality manual based on OIE guidelines was developed and under trial in 6 selected laboratories in Africa, Asia and Latin America.
All activities related with the preparation and use of the quality manual included in the work plan for 2002 were implemented or are in the process to be implemented. A workshop in Bogotá was carried out in September to make the final revision of the mentioned manual in particular the Spanish and French versions; experts missions to the participating laboratories have been implemented or will be implemented during the year; the training materials development in the project to facilitate the use of the quality manual developed is now available in English and have been translated into French and Spanish.

From AFRA
The technologies from AFRA included dam safety and ICT.
Please see separate report on this.

ARCAL LIX RLA/7/009 "QUALITY SYSTEM FOR THE PRODUCTION OF IRRADIATION STERILIZED TISSUE GRAFT"

The International Atomic Energy Agency (IAEA) has strongly supported several countries in the Latin American and Asian Regions in establishing or up-grading tissue banks that use ionising radiation as sterilizing agent.

It is through ARCAL LIX RLA/7/009 Project "Quality System for the Production of Irradiation Sterilized Tissue Graft" that, as one of its main objectives, a Code of Practice for Radiation Sterilization of Tissues was elaborated as a basis for the document to be approved and adopted by country representatives at an international level. This document was a result of three meetings, one held in Havana, Cuba in March 2001, the second in Monterrey, Mexico in June 2001 and the third at the National Institute of Nuclear Research (ININ), Mexico in February 2002.

ARCAL LIX RLA/7/009 is a project of the Latin American region which, together with East Asia and Pacific RAS/7/008 Project, are integrated into the Interregional Project INT/6/052 "Improvement of the Quality of Production and Use of Radiation Sterilized Tissue Grafts", responsible for implementing IAEA Programme on Radiation and Tissue Banking, and having among its main objectives the development of a Code of Practice for the Radiation Sterilization of Biological Tissues. Thus, this project links two regional projects and contributes to achieve a global treatment of the subject. Hence, the final Code of Practice will reflect the needs and views of all regions.

It should be noted that originally this interregional project was initiated as a sub-project entitled "Standards and Methods for the Production of Safe Radiation Sterilized Tissue Allografts" of INT/0/060 which initially had been assigned under the responsibility of ARCAL. Later, in view of the complexity of this interregional and the variety of subjects which had been put under one single project umbrella, this sub-project was assigned to be implemented separately under the framework of the interregional project INT/6/052.

The experience under the RLA/7/009 has brought other benefits to the region in addition to the drafting of the Code of Practice. The Agency has worked with Latin American countries on Tissue Banking since 1996 through national, regional and interregional projects. At present 7 countries: Argentina, Brazil, Chile, Cuba, Mexico, Peru and Uruguay have a total of 37 associated tissue banks.

The usefulness of Tissue Banking was dramatically evident as life saving during the explosion of fireworks in a popular commercial centre in downtown Lima, Peru. In this tragic event more than 60 people were treated for serious burns with irradiated tissue.

IAEA / ARCAL

ARCAL XXXVI - RLA/6/037

Standardization of Nuclear Nephrourology Techniques

(1999-2001)

ARCAL XXXVI - RLA/6/037

●ARGENTINA
●BOLIVIA
●BRAZIL
●CHILE
●COLOMBIA
●CUBA
●ECUADOR
●MEXICO
●PERU
●URUGUAY

ARCAL XXXVI - RLA/6/037

To achieve an agreement among the Latin American working parties for the establishment of norms and the standardization of protocols on diagnosis techniques used in nuclear Nephrourology

ARCAL XXXVI - RLA/6/037

●To homologize the cooperative jobs, looking for validation of techniques in the region

●To elaborate and periodically update, a handbook of norms and procedures for specialists in nuclear medicine and for the clinicians

●To generate the necessary references of commercial suppliers of equipment, in order to count on software programs that respond to the needs of the region

●To promote a greater diffusion and confidence in Nephrourology methods as starting point for the rationalization and normalization of the results

●To compile epidemiological data and information on human resources, instrumentation and supplies, that reflect the reality of the region

ARCAL XXXVI - RLA/6/037

●Consensus on nuclear Nephrourology methodologies more frequently used by Nuclear Medicine centers in Latin America. As a result, protocols more accord to the region –based on the experience and resources of each country, were elaborated.

●Standardization of radiopharmaceuticals and doses, according to clinical applications of nephrourological studies, as well as agreement on the most adequate techniques of acquisition and methods of processing of the information provided by gammagraphy reports.

●Elaboration, diffusion and adoption of the final version of the *Handbook of Norms and Procedures in Nuclear Nephrourology* –distributed to the participants during the workshop in Mexico.

ARCAL XXXVI - RLA/6/037

●The following Protocol Guides were reviewed and amended:

- *Studies of Renal Clearance*
- *Kidney Static Scintigraphy*
- *Kidney Dynamic Basal Gammagraphy and with Pharmacological Intervention*
- *Kidney Dynamic Scintigraphy in Renal Transplantation*
- *Radioisotopic Cystography*
- *Radio-Pharmaceutics Quality Control*
- *Equipment Quality Control*
- *Glossary of Terms*

●Each guide was written and revised by more than one of the Coordinators, and corrected by all of them with the active participation of the experts and the IAEA's Technical Officer

ARCAL XXXVI - RLA/6/037

MEETINGS

●First Coordinators Meeting. August 9-13, 1999, Montevideo, Uruguay. Participants: Project Coordinators from Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Peru and Uruguay. IAEA's Technical Officer, Dr. Ajit K. Padhy. Activities and budget of the project were defined.

●First Regional Workshop. November 15-19, 1999, Porto Allegre, Brazil. Participants: Project Coordinators from Argentina, Bolivia, Brazil, Chile, Colombia, Cuba, Mexico and Uruguay. IAEA's Expert: Dr. Rune Sixt Department of Pediatrics and Clinical Physiology, Queen Silvia Children's Hospital, Gothenburg, Sweden. Draft version of *Handbook of Norms and Procedures in Nuclear Nephrourology* was prepared.

●Second Regional Workshop. May 8-12, 2000, Buenos Aires, Argentina. Participants: Project Coordinators from Argentina, Brazil, Chile, Colombia, Ecuador and Uruguay. IAEA's Expert: Dr. Andrew J. W. Hilson, Royal Free and University College School of Medicine, University of London, UK. Prof. Ajit K. Padhy as Technical Officer. Work on second version of the *Handbook*.

ARCAL XXXVI - RLA/6/037

MEETINGS (Cont.)

●Regional Course on *Handbook* Applications. October 16-20, 2000, Havana, Cuba, for medical specialists from Argentina, Bolivia, Brazil, Colombia, Cuba, Chile and Peru. Drs. Pilar Orellana (Chile) and Daniel Schere (Argentina) attended as experts from IAEA.

●Final Coordinators Meeting. November 20-24, 2000, Lima, Peru. Participants: Project Coordinators from all countries. Dr. Keith Britton, of the St Bartholomew's of London, UK attended as IAEA expert and Prof. Ajit K. Padhy as technical officer.

●Workshop on Applications of the *Handbook*. August 6-10, 2001, Mexico City, Mexico. Total attendance of 64 included specialists in nuclear medicine from all participant countries and medical specialists in Urology, Nephrology, Surgery, Pediatrics and Radiology and internists, from host country. IAEA's Experts: Drs. Pilar Orellana (Chile) and Patricia Bernal (Colombia). Dr. A. K. Padhy attended as Technical Officer. The printed version of the *Handbook* was distributed among participants and comments to its contents were gathered.

ARCAL XXXVI - RLA/6/037

IMPACT ON THE REGION

●Project's main impact upon the region was the implementation of nuclear Nephrourology techniques, as well as their diffusion among the medical specialists, seeking to favor their greater utilization.

●In addition, working together with other specialists had as an outcome to provide an adequate and quality service to the patient.

●These attainments constitute a starting point for the formation of multi-center workgroups of nuclear specialists in Nephrourology techniques.

ARCAL XXXVI - RLA/6/037

DIFFICULTIES AND LESSONS LEARNT

- **Implementation of nuclear Nephrourology techniques has been hindered in several countries of the region, due to economical factors such as:**
  - Lack of updated equipment
  - Budget cuts
  - High cost of products due to their foreign origin
- **Work in collaboration with medical specialists was highly advantageous since it allowed the adaptation of nuclear techniques to the needs of clinicians and assisted them in providing an integral and precise nuclear diagnosis.**

ARCAL XXXVI - RLA/6/037

FOLLOW UP ACTIVITIES

●To hold periodical meetings among the Project Coordinators to update and modify the *Handbook of Norms and Procedures in Nuclear Nephrourology*.

●*Handbook*'s update could also be done at the meetings of the Latin-American Association of Biology and Nuclear Medicine Societies (ALASBIN), through a specific Chapter for the revision and updating of the standardization of nuclear Nephrourology procedures.

●Diffusion of the *Handbook* and of the regional Data Base throughout scientific journals and national societies, as well as local and regional courses directed to clinicians, nuclear physicians and medical technicians.

●To continue gathering and processing of information on epidemiological data, human resources, instrumentation and supplies, including requesting commercial houses the elaboration of software in accordance with countries needs.

TRIPARTITE FORUM MEETING, SEPTEMBER 2002

SUCCESS STORIES PRESENTED BY AFRA

I) <u>In the Field Information Communication Technologies (ICT) under INT/0/078 and RAF/0/013:</u>

As the information technology becomes now a new economy to educate and develop our human resources, interregional efforts have been made for the development of IC learning and training materials in an exploratory manner to examine the technical feasibility and economy of ICT tools and methodologies in selected least developed countries.

The development of ICT based training / learning material proceeded along three levels of varying complexity chosen for optimal implementation and cost effectiveness.

Developed ICT materials for training in troubleshooting have been mainly developed through direct contracts with experts in the field. This approach proved to be very efficient as well as cost effective. On average, the cost per module developed was about 5 000 $ US.
The following ten modules have been developed.

1. ICT training package fro MCAs including training kit and animation, by Mr D. Ponikvar; Slovania
2. Development of an ICT package for LSCs including operation, maintenance and troubleshooting; by Mr G. Govandarajan; India
3. ICT package for TLD readers including animation, by Ms O. Lemus (Cuba) and Mr P. Becker (Brazil)
4. ICT training module for analog electronics, including 40 animation and self-assessment options, by Prof. G. Pahor (Slovania);
5. ICT training package for troubleshooting selected amplifiers and pre-amplifiers including animations and self-assessment options, by Dr R. Krasowski (Poland);
6. ICT package for training on radiation sources and radiation interactions including animations and self-assessment options, by Dr Clikeman;(USA)
7. ICT package on theory and operation of gas detectors including self-assessment options, by Dr Clikeman (USA);
8. ICT package for training in digital electronics including animations and self-assessment options, by Dr D Ponikvar (Slovania);
9. ICT package fro training troubleshooting of survey meters including animations and self-assessment options, by Mr D.Barak (Israel);
10. ICT package for training on linear power supplies including animations and self-assessment, by Mr Burr (USA)

The developed materials have been sent to 8 selected trainers in the five regions to test them and to report on any deficiency or improvements that may be required.

For an effective use of the developed ICT materials, there must be sufficient trained trainers, adequate laboratory facilities where ICT materials can be used and a demand for such training/learning in the field. Therefore particular efforts were deployed under the regional project to establish ICT Tele-centres.

So far, **7 ICT Tele-centres** have been successfully established with a cost about 40 000 $ per each in Ethiopia, Sudan, Tanzania and Uganda to train various categories of personnel in maintenance.
And now this experience will be transferred to other AFRA countries, to facilitate the dissemination of information, experience and knowledge in the field.

II) SAFE CONDITIONING OF DISUSED RADIATION SOURCES IN AFRA AND NON-AGENCY MEMBER STATES

The reason for us to share this as a success story is because the conditioning of disused sources is a complicated matter which is the responsibility of the country its self. Since many African countries have not expertise to deal with this, an AFRA specialized team from South Africa has been established to assist these MS on an ad hoc basis. In most cases the disused sources are imported to South Africa for reuse.

The Agency transferred to AFRA the requests from MS for consideration. The cost involved were charged to the AFRA project RAF/4/015

ANGOLA

After accession to independence and dramatic civil unrest, this country decided to safely condition the known radiation sources available at the Department of radiotherapy in Luanda. The department is not operational since Portugal left the country.
An exploratory mission visited Angola to identify the known radiation sources, design adequate solutions and discuss with competent authorities the conditioning of these sources. The mission was undertaken by a team from South. The sources consist of a colalt-60 radiation source of about 500Ci in a teletron-80 machine and a cesium source in the original transport container. After identification of the known sources and discussion with the Agency and the competent authority in Angola the best technical option, the decision has been taken by the South African team to dismantle the sources and to export them to south Africa for re-use.

It should be noted that Angola is not a member of AFRA and therefore the consent of the 11th Meeting of Representatives was obtained to comply with article VIII of the AFRA Agreement. The whole operation required about 45,000$.

ETHIOPIA

Ethiopia has several disused radioactive sources which need to be conditioned in a centralised place. These include Americium and cobalt60 sources. Within one mission the AFRA specialised team conditioned radium sources and all other disused sources at the waste management centre.

MAURITIUS

Similarly to Ethiopia the AFRA specialised team also conditioned in one operation radium sources as well as the disused cobalt sources in one centralised place.

MOZAMBIQUE

During the eighties, radiation sources consisting of 3 cobalt sources; 2 Califonium sources, two orphaned Americium–Berillium sources were used in geological exploitation performed by companies from Russia and D.R of Germany. Due to civil unrest, these companies returned to their countries leaving behind containers with radiation sources without proper measures taken to protect the population, workers and the environment.
In 1995, the National Directorate of Geology tried to secure the known radiation sources
; but failed as there were refusal from the countries of origin to take back the sources. In 1997, the request was submitted to the Agency to assist with the conditioning of these sources. The same request was resubmitted in 2001 and AFRA was charged to deal with it. The 12th Meeting of Representatives approved exceptional assistance, in accordance to article VIII of AFRA Agreement, to Mozambique along this line. An exploratory mission will visit Mozambique 14-18 October 2002 to assess the status of the sources and propose adequate solution for safe conditioning. The

conditioning of the sources which are spread in three provinces will take place in early December 2002.Pending on the findings of the exploratory mission, some of these sources might be exported to South Africa for reuse.

UGANDA

Due to the civil unrest along the border with the D R of Congo, some radioactive sources were illicitly introduced into Uganda an emergency mission visited the country and identify the sources. The same South African team will visit the country 21-25 October 2002 to decide on the final solution for the safe conditioning of these sources (Cobalt sources). It could be that the sources will be exported to South Africa for reuse

SUDAN

Sudan has several disused radiation sources (Cesium and cobalt) which need to be safely conditioned . The same South African team will also visit the country in November 2002 to assist with the safe conditioning of these sources locally or to re-export them to South Africa for release.