International Atomic Energy Agency

THEMATIC PLAN ON

DIAGNOSTIC RADIOLOGY

Vienna, Austria
26 – 30 May 2003

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INTRODUCTION

Problem context

The developing and less developed nations of the world are still burdened by the problems of malnutrition and the scourges of infectious diseases, which to a large extent have already been controlled in industrialised countries. AIDS and tuberculosis exact a death toll of 13 million per year in the developing world. It must be stated that in many of these countries life expectancy is not high enough for the diseases, which are common in the industrialised countries to be viewed as important problems. However, as development proceeds in the developing countries, with associated improvement of social conditions, provision of safe water supplies and basic medical treatments, this situation will change.

It is well documented that average life expectancy is increasing in most countries. However, within developing countries, longevity is increasing linearly with time with the rate of increase being more dramatic than in industrialised countries. It is estimated that over the next ten years the incidence of the diseases associated with a "Western Lifestyle", characterized by a diet, rich in fat, refined carbohydrates and animal protein, combined with low physical activity, will increase by some 50% in the developing world. This represents a looming crisis for healthcare provision, but many developing countries are not cognisant of the scope of the potential health care problems and therefore, for instance, have no comprehensive national cancer control programme in place with the requisite human resources and appropriate financial support. It is this lack of understanding and preparedness that presents an imminent threat to citizens in the developing countries and a major challenge to healthcare providers.

Disease Context

Some of the diseases associated with the "Western Lifestyle" that are expected to increase significantly in incidence in the coming years in developing countries are the following.

Cancer

Cancer is the second leading cause of death in industrialised countries and is among the three leading causes of death for adults in developing countries. In the year 2000, malignant tumours were responsible for 12% of the nearly 56 million deaths worldwide from all causes. That is more than the percentage of deaths caused by HIV/AIDS, tuberculosis and malaria put together. (UICC, WHO 2003) Like the major infectious diseases, cancer is a public health problem for men and women, for young and old, and for rich and poor alike.

Once considered a "Western" disease, more than 50 percent of the world's cancer burden in terms of both numbers of cases and deaths already occurs in developing countries. Certainly, the causes and types of cancer will vary in different geographical regions but in most countries, there is hardly a family without a cancer victim. Data from the International Agency for Research in Cancer (IARC) predict that by 2020, regions with traditionally low numbers of cancer deaths could see alarming increases in mortality rates. Regions, including Northern Africa and Western Asia, South America, the Caribbean, and South East Asia, could face increases of over 75% in the number of cancer deaths by 2020 as compared to 2000 (WHO, 2003).

For no other illness is the early and accurate diagnosis and proper localisation of disease extent more important than in the case of cancer, and yet, in developing countries, 80 percent of cancer victims already have late stage incurable tumours when they are diagnosed. Diagnostic imaging of all types plays a crucial role in the diagnosis and localization of almost all types of cancer. It is also integral to the management of these patients as a means of monitoring the evolution of the tumour and the effect of treatment.

Cardiovascular diseases

Every year 12 million people worldwide die from cardiovascular diseases according to WHO, with most of them in developing countries. The main risk factors are high blood pressure, high cholesterol, and smoking, which are traditionally linked with affluent lifestyles but are now being seen in middle-income groups in poorer countries. Not only will the incidence of myocardial infarctions rise and be one of the leading causes of mortality, but also strokes (brain attacks) cause severe morbidity in the populations of developing countries, not to mention the loss of lower limbs from peripheral arterial disease. About half of all the strokes in the world occur in Asia. (Murray CJL, Lopez D. Global comparative assessment in the health sector, WHO 1994). In Sub-Saharan Africa and the Caribbean, the case fatality rates for strokes are 1 to 3 fold higher than in industrialised countries.

In the past catheter angiography has been one of the primary diagnostic tools in the investigation of these diseases. However, it is increasingly being replaced by other imaging modalities such as CT or MR angiography, which are not only less invasive and less expensive but require less operator skill. Contrast enhanced MR and the latest generation of multi-detector CT are now getting to the point of being able to image a large proportion of the coronary arteries and are already replacing catheter angiography for assessment of renal, aortic (thoracic and abdominal) and the lower limbs vessels, as well as the carotids and the intracranial vessels. In addition, the ability of MRI to quantify ventricular ejection fractions, shunt sizes and the perfusion and viability of myocardium is acceptable in daily practice. Imaging is also being used to identify those patients who have early signs of atherosclerotic disease by either measuring coronary artery calcium, intimal medial wall thickness of the carotids or by directly visualising the atherosclerotic plaque in the carotids or coronary arteries and then following them to determine if there has been response to therapy being instituted.

Although catheter angiography is being replaced in the diagnosis of cardiovascular diseases, interventional angiographic procedures still play a major role in the treatment of these diseases.

Osteoporosis

The WHO has listed osteoporosis as one of the most important chronic diseases today, with a high socio-economic impact. Worldwide, 200 million women may be affected, with at least one in every three women over the age of 50 suffering from an osteoporosis fracture in their lifetime. The most common fractures associated with osteoporosis are fractures of the hip and the vertebrae. It is estimated that hip fractures alone cost about $10 billion per year in the United States. With the predicted increase in the number of older people worldwide, the number of hip fractures could rise from 1.7 million in 1990 to 6.3 million by 2050. It is estimated that 71% of these fractures will occur in developing countries. The development of newer drugs to treat patients with osteoporosis necessitates that those at risk of disease are diagnosed early before they suffer fractures, which in the elderly often result in early death

from complications such as pneumonia. There are numerous radiological methods available for detecting osteoporosis from dual energy absorptiometry (DEXA), quantitative ultrasound (QUS) to quantitative CT (QCT), and these are also used to determine response to treatment.

Multi-organ Trauma

Multi-organ trauma, which is one of the commonest causes of death in young adults in industrialised countries, is becoming an increasing problem in developing countries. Armed conflicts result in multi-organ trauma to patients of all ages. In South East Asia, motor vehicle accidents are the commonest cause of mortality of young adults (reference) and this has been showing a steady increase.

Although these diseases characteristic of the industrialised lifestyle, are dramatically increasing in importance in developing countries, at present, the most common illnesses requiring diagnostic radiology in developing countries are simple limb fractures and diseases of the lungs caused by infections such as tuberculosis.

The technology context

Over the last several decades dramatic technological advances in medical imaging have placed imaging at the centre of patient management. In the absence of proper diagnosis no rational treatment can be provided and therefore the outcomes expected from any form of treatment would be far from satisfactory. Medical imaging (which is the creation of images of internal structures of the body using a variety of technologies such as x-rays, ultrasound, CT, MRI, nuclear medicine) plays a key role in the diagnosis of countless diseases from infection to infarction, from testicular torsion to tumours and from osteoporosis to osteogenesis imperfecta. There is scarcely a disease process in which diagnostic imaging techniques have no place.

Medical imaging uses a variety of technologies such as x-rays, ultrasound, CT, MRI and nuclear medicine. X-rays, CT and nuclear medicine all involve ionising radiation. Although ionising radiation is not used in MRI, it is a technique using the nuclear spin of protons to probe and visualize the chemical structure of tissues. Ultrasound is the only common imaging modality that does not have a nuclear basis. However it must be recognised that the separation of imaging based on modalities is artificial as all of these are but tools used either alone or in combination to arrive at the diagnosis and plan treatment in the most cost-effective and efficient way. In addition it is inescapable that the appropriateness of modalities would depend on the availability of equipment and expertise such that what is being practised by the most advanced nations may not be possible let alone expected in a less developed nation.

The phenomenal development of computer processing has led to revolutions in imaging, for example the ability to do 3-D reconstructions of data-sets allowing for techniques such as virtual endoscopy for the assessment of the colon, bronchi or even blood vessels. In recent years, over-laying and fusing images from different modalities has provided additional medical information to improve diagnosis and to localise and gauge the severity of disease. Other computer-based advances include computer-aided detection and diagnosis for breast and lung nodules, image management systems and radiological information systems. The development of digital imaging has prompted the development of teleradiology, the transmission of images electronically across wide distances, which can provide remote areas rapid access to specialists for the interpretation of diagnostic imaging procedures.

And now we are entering a new age of “Molecular Imaging”, the ramifications of which are not easy to predict but will certainly be extensive. This technique involves the use of specific tumour or gene markers to facilitate disease detection and to determine treatment response at the cellular or gene level much earlier than would be possible with current imaging modalities.

The traditional role of diagnostic imaging, as its name implies, has been in the diagnosis of infectious disease such as tuberculosis and it remains an essential tool for use in the setting of fractures. However, image-guided interventional radiology is rapidly developing as a minimally invasive and cost-effective modality of treatment. In this technique, medical imaging (ultrasound, fluoroscopy, CT and even MRI) is used to guide the radiologist in therapeutic manoeuvres such as angioplasty, embolisation, radio-frequency and ethanol tumour ablation, local chemotherapy delivery and abscess drainage, often most of these under local anaesthesia and sedation only. These techniques are less invasive than traditional surgical techniques, allowing the patient to recover much faster, and they are also less expensive.

Although diagnostic imaging technology has made remarkable advances in the last few years, these advances have come with a price, and that price is not only financial. The more advanced imaging equipment also requires a much more advanced support structure. Therefore, the needs of Member States cannot be solved simply by the provision of equipment alone. Technology transfer requires an appropriate level of physical infrastructure (adequate and stable power supply as well as controlled cooling and humidity and dust control) and technical expertise to enable the equipment to function properly. Another important area is that of quality assurance and quality control, both essential for ensuring reliability. It also requires the training and development of local medical expertise since physicians are responsible for the diagnosis and treatment of patients and equipment is simply the means to achieve the desired end.

Proposed Programme Strategy

Due to the vital importance of imaging in both the diagnosis and management of disease processes, there is a need for a greater coherent international effort to help the developing nations create strategies for the incorporation of imaging into their healthcare systems. To meet the needs of such countries, a comprehensive programme is required to take into consideration the availability of local expertise (medical and technical), the infrastructure (stable electrical supply, water and air-conditioning) and the disease pattern or burden. In short, the total solution requires coordinating Agency efforts with those of other partners.
The Agency already has programmes in nuclear medicine and radiation therapy supported by activities in dosimetry and medical physics. Through the TC fund the Agency already supports projects in some areas of diagnostic imaging, dosimetry and radiation protection, but it lacks a comprehensive programme to provide a systematic approach focusing on the medical aspects of imaging science and including all the imaging technologies (*Appendix 1).* Member States require the Agency’s assistance in this area since no single UN organisation has the resources or the expertise to do the entire job without help.

In considering the role the Agency could play in supporting the development of effective diagnostic imaging in developing countries the meeting recognized that there are, *broadly speaking,* two problems both of which are on a daunting scale:

Scenario A – The basic level: The need for the provision of the most basic of medical equipment and services to those essentially under developed nations who have virtually no infrastructure or trained personnel.

Scenario B – The advanced level: The need to improve and upgrade the established medical equipment and medical services in those developing countries who have them and who have some infrastructure and trained work force to support them.
It should be recognised, however, that in some countries elements of both problems co-exist in different locations.

The Agency's approach to these two different scenarios would have to be somewhat different, and these approaches will be discussed in more detail shortly. However, there are certain general principles which should underlie any comprehensive program in diagnostic imaging, and these should be considered first:

i. Sustainability for the safe and effective use of imaging technology requires a long-term commitment by the Member State to ensure the necessary physical and technical infrastructure as well as on-going professional development of existing and newly recruited staff. Indeed, as shown in its existing programmes, by providing expertise and independent advice during project formulation, equipment specification and purchasing, facility commissioning and training of medical and support staff, the Agency is able to produce significant impact on the health care agenda of Member States.

ii. Appropriate levels of technology need to be identified. Careful consideration must be given to the type of imaging equipment best suited to the purpose in different centres and situations. There are now a number of diagnostic imaging modalities and any comprehensive plan for diagnostic imaging must include all these modalities because they each have their own roles and advantages and disadvantages. Basic radiographic units and ultrasound equipment (particularly portable units) are the least expensive, require the least infrastructure and can be operated by personnel with only basic training. These modalities can be most widely disseminated and they provide excellent diagnostic support for primary medical care. Secondary referral centres that have surgeons and other medical specialists or easy access to such support could benefit from fluoroscopy, a basic CT, more sophisticated ultrasound as well as radiography. However, these modalities require a more stable infrastructure and more highly trained personnel to function effectively. The most sophisticated imaging equipment, MRI, high-end CT, nuclear medicine and PET is most logically placed in tertiary referral centres because it requires the most extensive and reliable infrastructure and personnel with the most advanced training.

iii. As a corollary to this, balance must exist between the technology levels in diagnosis and treatment. For example, there would be little gain in providing advanced diagnostic capabilities for patients who have cancer or heart diseases to a centre that has no relevant associated local or regional therapy capabilities, or vice-versa. There is a need to define the medical needs and present capabilities of any country or centre requesting assistance under this programme. Agency tools such as the Country Programme Framework could play a key role in this process.

iv. Structures for continuing assessment and validation must be an essential part of any project, and any projects supported should be sustained for up to at least 10 years with the ultimate goal of handing over responsibility to local control when appropriate.

There are also certain practical considerations that would be important in the development of a program in diagnostic imaging:

a. The Agency should work with existing programmes and initiatives whether its own, whether local, or whether involving other governmental, inter-governmental or non-governmental agencies. It should be a facilitator in these matters. In particular, in the matter of basic imaging in the less developed world it should seek to collaborate with the WHO, PAHO and ISR.

b. Where training is the issue, the Agency should seek to tap into local facilities and programmes where these exist or into the existing courses of bodies such as the RSNA, EAR, ISR, IOMP and the equipment manufacturers. Setting up of new tailored programmes in collaboration with such bodies should be the aim where no pre-existing programme is appropriate to needs. Training should be appropriately practical and hands-on where possible and should match available local resources. Where some level of local expertise exists the aim should be to use this as a resource to train more widely in the region. This will help achieve diffusion of expertise. At the same time, the level of expertise of already trained individuals should be appropriately raised by organising training, elsewhere, regionally or internationally.

The approach to the two different scenarios described above will now be discussed in more detail.

Scenario A. – Basic Level

In areas where there are only very basic health services available, the provision of basic diagnostic imaging equipment can be of great value. This would include a simple x-ray machine and a basic ultrasound unit. This type of equipment is generally quite reliable and requires only limited physical resources such as an electrical supply. It does not necessarily require trained technologists, because other medical personnel can be trained to use it. It also does not necessarily require the presence of radiologists, because other physicians can be trained to provide preliminary interpretation of the images. The hard copy images can be sent to a more advanced regional center where radiologists are available for final interpretation. If appropriate facilities are available, teleradiology might also be used.

Clearly the provision of this type of low technology equipment, with appropriate training, should be the goal in the least developed regions. Currently, the WHO, PAHO and ISR are providing basic equipment and training in a handful of centres in the under-developed world to create local centres of excellence in low-technology imaging. Representatives from some of these organizations who were at the meeting indicated that they would welcome collaboration with the Agency. The Agency should approach all these organizations to determine how it could best support their existing programs, perhaps by enabling more personnel from the least developed areas to attend the existing training programs of these organizations.

Scenario B – Advanced Level

The Agency can play a more pro-active role in supporting the development of advanced diagnostic imaging in developing countries, because it has already considerable relevant experience through its nuclear medicine and radiation therapy programs.

The problems associated with Scenario B are already being tackled in regard to radiation therapy equipment by the IAEA so there is a track record in the Agency in this area. It would clearly be appropriate for the Agency to add a Diagnostic Imaging dimension to its activities since therapy and diagnosis are inextricably linked. It also follows that *some* concentration of efforts in the diagnostic imaging field should be in those regions already supported in therapy. Here the emphasis will be more on advanced technology such as CT, nuclear medicine and MRI. PAHO is also active in this area and collaboration with PAHO would be fruitful.

There are a large number of national hospitals, which have at least one of the more advanced modalities for diagnostic radiology in the developing countries. Thus, the number of staff involved in diagnostic radiology is large in each country. Accordingly, it is very difficult to meet the national needs for training using the traditional approach of the IAEA of sending individual fellows abroad for training. To achieve this goal in a cost effective manner, it is necessary to emphasize a *train the trainers* approach to maximise the impact of training programs. In order to ensure the effectiveness of this approach in a given country, it is necessary to identify an appropriate collaborative centre to act as a focal point at the national level and to be considered as a reference centre in the country. This will involve a great deal of responsibility in such institutions, as they have to coordinate and carry out all the activities. To maximize the impact at the national level, the Agency should serve as coordinator/facilitator to enhance the co-ordination between national institutions and governments. This coordination may be formalised by encouraging governments to develop a network of participating radiodiagnosis departments, and to assign formally the national focal point institute the responsibility for ensuring proper linkages at the country level.

In order to enhance TCDC, it is possible to identify certain regional resource units/ collaborative centres to help in conducting training and to provide advice to other developing countries. This is in response to TC Strategy in which the Agency intends to strengthen regional cooperation by encouraging the more advanced national institutes within regions to contribute fully to solving problems within the region. This type of cooperation will ensure the most effective use of the limited financial resources under the Agency's TC Programme. International centres of excellence could also play a role in providing advanced training.

The IAEA, Board of Governors has endorsed the TC Strategy, which, among other elements, features the concept of expanding the impact outputs and outcomes through partnerships with other organizations in the field of activity such as governmental, professional, intergovernmental and non-governmental international organizations. The Agency should use the existing courses of bodies such as the professional societies, namely ISR**,** RSNA, EAR**,** CIR, AOSR, WFUMB, WFNM and continental imaging societies AOSR, ANZCR, CIR, EAR, IOMP for training radiologists, ISRRT for training radiographers and medical technologists and IOMP and EFOMP international training programmes for training medical physicists. For example, in its radiation oncology and medical physics programs, the Agency's recent cooperation with ESTRO in conducting training for East European countries, has demonstrated the effectiveness of such collaborative training programmes. There should also be collaboration in this area using the existing training programmes of such international bodies as WHO and

PAHO. Equipment manufacturers should also be invited to participate, in providing specialised training programmes for QA and maintenance of medical imaging equipment.

Training projects are best delivered at the point of need even if this involves foreign faculty. There should be a strong practical (hands-on) component to the education and students should be recruited regionally to ensure dissemination of skills within the area of need. Resource material should be provided for project participants for prior study. To achieve sustainability and self-reliance, those involved should be encouraged to recognize that education is a lifelong process requiring continuing professional development.

Training could be conducted through a variety of structures such as:

1. National workshops with the help of the Agency's experts in collaboration with the national focal points centres.

2. Regional workshops/training courses using the existing training programmes/curricula for trainers.

3. Individual fellowship/group fellowships at international collaborative centres/centres of excellence.

In developing its projects IAEA should, as a facilitator, consider the following:

- A needs assessment in respect of both educational and local human and technical resources. Benchmarking of staffing and equipment levels should be used in priority setting.
- Determination of the existence of available educational programmes by region and by nation.

The following types of projects should then be considered:

- Educational projects (for all relevant professional groups**)**

- Implementation of standards (e.g. acceptance and quality control testing)

- Implementation of guidelines (e.g. referral criteria, screening)

- Upgrade of existing imaging equipment to support advanced radiation treatment and educational initiatives in conjunction with such upgrades.

- On those occasions when entirely new projects are developed there may be little existing infrastructure and the project implementation will tend to occur in the longer term.

The projects will be of varying length and complexity. The projects should be directed to any or all of the following, recognizing the availability of local resources:

- Medical physicists

- Radiologists
- Radiological nurses
- Allied scientists and technologists
- Other health care workers with different levels of expertise.
- Identification of relevant professional groups is a pre-requisite for implementation. For these programmes to succeed national administrations must recognise and validate qualifications that are primarily academically recognized. National authorities should be encouraged to legislate recognition of graduates, e.g. through health professions acts and certification. Such recognition should ultimately meet international standards when they are formulated.

The role of IAEA will include aspects of funding. Matching funding from local resources, IAEA and other organisations in differing combinations should be sought. IAEA should continue to be involved in funding international study for students and teachers.

Governments may participate in these IAEA programs acting on their own initiative or in response to needs identified by organizations in their own countries, such as universities, or other national agencies. The IAEA should advertise its interest in supporting bids for participation in the above projects and in such bids:

- There should be an evidentiary basis for initiatives (appropriateness)
- Initiatives should be matched with available expertise and infrastructure
- Funding should have local matching component
- There should be well-defined and achievable objectives
- There should be a built in evaluation component involving examination of process and outcomes in both short- and long-term time frames.

IAEA should use its experience in quality assurance and process control to ensure continuous programme improvement. Moreover, IAEA should consider using external consultants to evaluate the initial bid and the project’s progress and make appropriate recommendations as it evolves.

Conclusions

The meeting agreed that the IAEA has proven capability for assisting the developing and lesser-developed countries through its human health division via the technical co-operation agreements with Member States. The Agency has put in place nuclear imaging and radiation oncology systems, which are appropriate for the needs of the countries taking into consideration the local situation. It has also managed to facilitate training for the human resources necessary to have such facilities function effectively.

The meeting envisioned a role for the IAEA in assisting the development of diagnostic imaging facilities in countries with the most basic needs. This would be done in cooperation with organizations like WHO, PAHO and ISR, which are already active in these areas. There is also a role for IAEA in the development of more advanced imaging modalities so that all Member States can reap the full benefits of what imaging has to offer in improving the level of healthcare available to citizens as stated in the strategic goal for technical co-operation with Member States that it "shall increasingly promote tangible socio-economic impact by contributing directly in a cost-effective manner to the achievement of the major sustainable development priorities of each country."

Action Plan

The meeting defined the following specific activities that should be carried out by the Agency in the development of a thematic programme in diagnostic imaging:

1. The Agency will need in-house expertise and external consultancy arrangements and the individuals involved will have to establish their bona fides with all the collaborating groups. The Agency should, therefore, ascertain in-house competence, both radiological and technical, and where necessary seek appropriate external consultancy arrangements to work on this programme, which merits strong and expert direction.

2. The Agency should approach WHO, PAHO and ISR to discuss the possibility of collaborating with their programmes designed to assist developing countries in establishing basic diagnostic imaging facilities in the areas of greatest need. This activity could be developed very quickly, because these other agencies already have well-established programs in this area in place.

3. The Agency should develop a document defining the appropriate specifications for imaging requirements for centres of basic, secondary and advanced imaging. This document should also define the infrastructure, such as guaranteed power supplies and air conditioning, and technical and human resources, including technologists, radiologists and medical physicists, that are necessary for the equipment to function effectively and reliably on a long term basis. Equipment manufacturers could be of assistance in this process in providing guidelines for technical and infra-structural prerequisites for the suitable installation of their equipment. This activity is considered to be very important and should be started as soon as possible. It should be a short-term project.

4. The Agency should explore the feasibility of establishing a database of equipment, particularly advanced equipment in the developing countries. It was suggested at the meeting that equipment companies might be willing to cooperate in the development of such a database. There is some anecdotal evidence that non-UN initiatives to supply diagnostic equipment to the developing world may be in danger of being wasted as insufficient attention has been given to the principle of sustainability. Such a database might identify these situations, and Member States should be encouraged to consult the document described in the preceding recommendation prior to purchasing or acquiring new diagnostic imaging equipment. This action could be initiated in the short-term, but it would probably take some time to complete.

5. The Agency should undertake a needs assessment to determine the training requirements to support the development of more advanced diagnostic imaging facilities in developing

countries. These needs will vary to some extent from country to country and region to region. Once the training needs are established the Agency should consult with the various national and international professional societies to determine if they have existing training programs that would meet these needs. If not, their collaboration should be sought to develop appropriate training programs. This would be a longer-term project.

6. Because the Agency's funds are limited we would recommend that its diagnostic imaging program be primarily focused on training. However, the possibility of providing some support for equipment purchase, as is done in the nuclear medicine and radiation therapy programs, should be considered. Other potential funding partners such as the OPEC fund and EU could be approached to augment the resources for the purchase of equipment.

7. The Agency should in five years time convene a meeting of experts similar to those that attended this meeting to review the activities and progress of the diagnostic imaging programme and to review its goals to ensure that they are still appropriate to the Member States' needs.

APPENDIX 1

The Agency's TC programme

The IAEA, as a specialized agency of the United Nations system, serves as the world's foremost international governmental forum for scientific and technical co-operation in the peaceful use of atomic and nuclear technology. In addition to areas where the IAEA is known to play a major role such as safeguards and waste management or radiation safety and protection, the Agency has a mandate also to foster the peaceful use of nuclear science and technology e.g., in the fields of food and agriculture, human health and natural resources. In this capacity, the IAEA is charged with constantly assessing its contribution, appropriate techniques and linkages to priority problems.

The Agency's Technical Co-operation Programme, with an annual budget of approximately 73 million USD (from voluntary donations), is one mechanism for assisting Member States to utilize nuclear technologies to address key sustainable development problems. This, combined with research and development activities funded by the IAEA Regular Budget of 230 million USD (from Member State contributions), enables the IAEA to play a role in assisting to meet national and regional development objectives from scientific investigation all the way through to technical applications.

In the field of human health, the Agency employs a total of about 35 people including 6 who are physicians and another 14 who are medical scientists. Presently the staff is organized into 4 sections: Nuclear Medicine (NMS); Applied Radiation Biology and Radiotherapy (ARBR); Dosimetry and Medical Radiation Physics (DMRP); and, Nutritional and Health-related Environmental Studies (NAHRES). Combining the regular budget and the TC funds used to support human health initiatives within Member States, the total budget is about 35 million USD.

Most existing projects in imaging science are handled by the staff of the NMS. For example, there is a project to assist in establishing a nuclear medicine imaging unit and providing nuclear medicine imaging services to sick children in Sri Lanka. However, much of the demand for precision localisation of disease comes from the cancer treatment field and the work of ARBR. The implementation of Multi-Leaf Collimators (MLC) on linear accelerators in Brazil in order to deliver dose to the patient's tumour whilst sparing the surrounding healthy tissues demands an accurate method to distinguish diseased tissues from normal. The work of DMRP is meant to assist and enable the health related activities in both diagnostics and treatment.

APPENDIX 2: ACRONYMS

ISR	International Society of Radiology	www.isr.org
ESTRO	European Society of Therapeutic Radiology and Oncology	
ANZCR	Australian and New Zealand College of Radiologists	
ICTP	International Center for Theoretical Physics	
IOMP	International Organization of Medical Physicists	www.iomp.org
ISRRT	International Society of Radiographers and Radiological Technologists	
PAHO	Pan-American Health Organisation	www.paho.org
WFNMB	World Federation of Nuclear Medicine and Biology	
WFUMB	World Federation of Ultrasound in Medicine and Biology	
RSNA	Radiological Society of North America	www.rsna.org
CIR	Inter-American College of Radiology	www.cir.org
EAR	European Association of Radiology	www.ear-online.org
AOSR	Asian Oceanic Society of Radiology	www.aosr.org
EFOMP	European Federation of Organisations for Medical Physics	www.efomp.org
CoE	Centres of Excellence	

APPENDIX 3

IAEA Thematic Planning Meeting on
Diagnostic Radiology
Vienna, Austria, 26-30 May 2003
(Scientific Secretary: Ken Shortt)
(Meeting Coordinator: C. Nelima Okhoya)

Meeting Agenda
Meeting Room: B0545

Monday, 26 May	
08.30-09.00	**Registration**
09.00-09.15	**Session 1a: Opening** Welcome Remarks by S. Groth, Director, Division of Human Health (on behalf of W. Burkart, Deputy Director General, Department of Nuclear Sciences and Applications)
09.15-09.30	Discussion and Adoption of Agenda
09.30-10.30	• IAEA's Programme on Human Health- ***S. Groth*** • IAEA's Technical Cooperation Programme and Thematic Planning Process - ***R. F. Kastens*** • Designation of Chairperson and Rapporteur
10.30-11.00	**Break**
11.00-12.30	**Session 1b**: **Setting the Problem Context for the Application of Diagnostic Radiology within Health Care.** *This session is intended to set the context of the problem of health care in developing countries with emphasis on the needs in diagnostic radiology. It will focus on the requirements for human, technical and financial resources as well as the general support of donor organisations.* • ***Peter Dawson*** – United Kingdom • ***Caridad Borras*** (formerly PAHO)
12.30-14.00	**Lunch Break**
14.00-15.30	**Session 2a: Present Status (IAEA).** *This session focuses on present activities between Member States and the IAEA as the starting point for a potential new programme in diagnostic radiology.* **IAEA Programme and Activities** • ***Naoyuki Watanabe***: The IAEA's Programme in Nuclear Medicine (NMS) • ***Jolyon Hendry***: The IAEA's Programme in Applied Radiation Biology and Radiotherapy (ARBR)

	• ***Ahmed Meghzifene***: The IAEA's Programme in Dosimetry and Medical Radiation Physics (DMRP)
15.30-16.00	**Break**
16.00-18.00	**Session 2b: Country Cases – Status and Experiences** *This session focuses on country cases that are meant to summarise activities and needs in the area of diagnostic radiology within Member States, essentially specifying their current situation and outlining what they foresee in the future.* Basri Abdullah - Malaysia • ***Ricardo Brentani***– Brazil • ***Jan Labuscagne*** – South Africa • ***Boudjema Mansouri*** - Algeria
Tuesday, 27 May	
09.00-10.30	**Session 3a : Opportunities and Constraints** **Professional Societies** • ***Brian Lentle*** – RSNA • ***Holger Pettersson*** (Gerard D. Hurley) – EAR • ***Jan Labuscagne*** (Hans Ringertz) – ISR **Industry's Viewpoint** • ***Pierre Renard*** – Siemens • Dietmar Gruidl – GE **Donor's Viewpoint** • Mahmoud Khene – OPEC Fund
10.30-11.00	**Break**
11.00-12.30	**Session 3b : Opportunities and Constraints** **Technical Issues** • ***Martin Reed***– Canada • ***Robert Nowotny*** - Austria • ***José Carlos Da Cruz*** – Brazil
12.30-14.00	**Lunch Break**
14.00-15.30	**Session 4a: Visioning - Defining the Future** *The session seeks to apply knowledge gained from the foregoing sessions to visualize a desirable future situation and address the question, "Where do we want to go?"* Discussant: ***Peter Dawson***
15.30-16.00	**Break**
16.00-18.00	**Session 4b: Convergence** *By characterising the necessary technical, institutional, operational and*

	partnership factors, participants will identify processes/steps that are required to make the link between the situation analysis and the future (vision) by providing answers to How? When? Where? With Whom?
	Defining the IAEA's role
19.00	**Dinner**
Wednesday 28 May	
09.00-10.30	**Session 5a: Summary and definition of working groups**
	Chairperson's Summary of Previous Day
	Formation of Working Groups: the roles for the IAEA, Member States and Partners (Industry, donors and NGOs)
10.30-11.00	**Break**
11.00-13.00	**Session 5b**: **Defining A Future IAEA Programme on Diagnostic Radiology**
	The starting premise of this session is that there is a problem which can be addressed using diagnostic radiology, a role, which although strategic and longer term in nature, may require some immediate action. Notwithstanding, the primary focus of IAEA's programme should be to address the technical and management requirements of national programmes.
	Key programme elements: • Major Issues • Partnerships - roles and responsibilities • Institutional/Resource requirements • Next steps/Follow-up: immediate, medium and longer term • Pilot/Feasibility activities
13.00-14.30	**Lunch Break**
14.30-15.30	**Session 6a: Working Group Discussions (cont.):**
15.30-16.00	**Break**
16.00-18.30	**Session 6b: Working Group Presentations**
Thursday 29 May	
09.00-10-30	**Session 7a: Planning**
	Plan formulation and discussions
10.30-11.00	**Break**
10.30-12.30	*Session 7b: Drafting Groups* ***Working Group Drafting***
12.30-13.30	**Lunch Break**
13.30-15.30	**Session 8a: Concluding**
	Working Group Drafting
15.30-16.00	**Break**

16.00-18.00	**Session 8b: Conclusions and Recommendations**
Friday, 30 May	
09.00-10.30	**Session 9a: Reporting** Review of Draft Report
10.30-11.30	**Break**
11.30-12.30	**Session 9b: Agreement on Chairperson's Report**
12.30-13.00	**Closing by Ms. Ana-Maria Cetto, Deputy-Director General, TC**
14.00	**Follow-up discussions with IAEA staff (NAHU/TCPA/TCPB)**

Summary Information on Each of the Sessions

Session 1 – Setting the Problem Context for Diagnostic Radiology within Health Care

This session is intended to set the context of the problem of health care in under-developed countries with emphasis on the needs in diagnostic radiology. It will focus on the understanding of human, technical and financial resources as well as the general role of donor organisations.

Session 2 – Present Status

This session focuses on existing activities within the IAEA to understand some of the details of what is being done within the Health Care sector already. Lessons learned and methodologies used within existing programmes may help to guide the discussion on programme development and structure to be used in diagnostic radiology. Country Cases are meant to summarise experience and needs in the area of diagnostic radiology within Member States, essentially specifying their current situation and outlining what they foresee in the future.

Session 3 – Opportunities and Constraints

This session focuses on technical aspects (opportunities and constraints) on the use of diagnostic radiology. The presenters will also propose new ideas and identify future trends. The potential role for professional societies, industry and donor organisations will be discussed.

Session 4 – Visioning

The fourth session seeks to apply knowledge gained from the foregoing sessions to visualize a desirable future situation where national authorities and partners possess the technical know-how and human resources capabilities to effectively use diagnostic radiology in the diagnosis and precise status of human diseases. By characterising the necessary technical, institutional, operational and partnership factors, participants will in this session identify processes/steps that are required to make the link between the situation analysis and the future (vision). Some key issues to be answered include: What needs to be done to achieve national recognition of the problem (desirable future)? Where and how will diagnostic radiology contribute the most? What implementation strategies should be considered by the IAEA, and with what focus?

The principal output of this session is conceptual agreement on questions of ***how, when, where and with whom*** *relative to a possible IAEA programme on diagnostic radiology. More specifically: immediate, medium and long-term objectives and programme priorities; identification of roles and responsibilities; targets and timeframes; identification of actions that eventually converge at the TC project level. We will endeavour to move the developing concepts from the abstract to a concrete programme strategy. The Rapporteur plays a key role in recording the logical development of the discussion and any agreements reached, as they become the centrepiece of the report.*

Sessions 5 & 6 –- Summary and Formation of Working Groups Defining A Future IAEA Programme in Diagnostic Radiology

This session in working groups is intended, to define a programme development strategy taking into account the major players. The starting premise is that the meeting thus far has concluded favourably that there is a problem where diagnostic radiology has a clear, well-defined and practical role to play in

managing malignant and other associated diseases. In this Session, the link to Session 3 comes from the conclusion that some form of programme development is feasible and the areas where the Agency can contribute are identifiable.

Session 7 – Planning

This session summarises the presentation of the working group and prepares the outline of the necessary action to develop the Agency's programme in diagnostic radiology. The working groups re-convene to draft specific language for the conclusions and recommendations that will indicate clearly the next steps to be taken by all stakeholders.

Session 8 – Concluding

As a set of conclusions and recommendations for further action, it may be necessary to agree upon a list of prerequisites and enabling conditions required to establish an Agency programme in diagnostic radiology.

Session 9 – Reporting

The draft report has to be finished and agreed upon prior to closing the meeting.

APPENDIX 4

THEMATIC PLANNING MEETING ON
DIAGNOSTIC RADIOLOGY
VIENNA, AUSTRIA 26 –30 MAY 2003

List of Participants

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