INTERNATIONAL ATOMIC ENERGY AGENCY
UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION

INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS
34100 TRIESTE (ITALY) - P.O.B. 586 - MIRAMARE - STRADA COSTIERA 11 - TELEPHONE: 224081
CABLE: CENTRATOM - TELEX 460392-1

SMR.300 - 18

COLLEGE ON MEDICAL PHYSICS

10 October - 4 November 1988

IAEA/WHO
Quality Assurance Programmes in Nuclear Medicine

** these notes are intended for internal distribution only

NEWSLETTER:

IAEA/WHO QUALITY ASSURANCE PROGRAMMES IN NUCLEAR MEDICINE

No.1 MAY 1986

Jointly prepared by the INTERNATIONAL ATOMIC ENERGY AGENCY,
Division of Life Sciences, Vienna, Austria

and the
WORLD HEALTH ORGANIZATION
Division of Diagnostic, Therapeutic and Rehabilitative Technology,
Geneva, Switzerland

Published by the INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA, AUSTRIA

CONTENTS

Editorial Note 3

Introduction 3

Quality Assurance in Nuclear Medicine 4

The results of the First WHO Interlaboratory Comparison of Nuclear Medicine Imaging Devices 6

Quality Control of Nuclear Medicine Instruments, A Technical Document issued by the International Atomic Energy Agency, Vienna, 1984 8

IAEA Regional Technical Co-operation Projects on the Quality Control of Nuclear Medicine Procedures in vivo 9

The Joint WHO/Institut für Strahlenhygiene (FRG) Training Workshop on Quality Control in Nuclear Medicine held in Neuherberg, Munich, 23-30 November 1983 11

Training Workshop on Quality Assurance in Nuclear Medicine held in Kuwait, 9-13 December 1984 12

WHO Collaborating Centres in the Field of Nuclear Medicine 13

Recent Publications on Quality Assurance in Nuclear Medicine 15

The views expressed by the individual authors do not necessarily represent those of the two organizations concerned.

Editorial Note

Promotion of quality assurance in nuclear medicine, and in other fields of radiation medicine, is one of the most important activities of the Radiation Medicine Unit in WHO and the Division of Life Sciences in the IAEA.

The nature and extent of quality-assurance measures will vary with the size and type of facility, the type of examination conducted, the type of therapy administered, and various other factors. Three main objectives should be envisaged when quality-assurance programmes are considered:

(i) improvement in the quality of diagnostic information and therapeutic procedures;

(ii) use of the minimum amount of radioactivity or radiation that allows attainment of the desired diagnostic information and therapeutic results;

(iii) effective use of available resources.

Ultimately the quality of radiation medicine depends upon the practices in individual laboratories. Some of these, through their own initiative, have already introduced quality-assurance measures. In some countries it is already national policy to stimulate laboratories in this direction. On the international plane, WHO and IAEA seek to encourage both individual laboratories and national policy makers in these endeavours: to assist training, to stimulate adoption of consistent procedures for assessing quality, to help assure the availability of essential devices, to ensure access to international standards and calibration, and to systematize and facilitate exchange of relevant information. This Newsletter is one element in this effort in the particular field of nuclear medicine.

Introduction

The main purpose of this newsletter is to bring information about the relevant activities of the World Health Organization and the International Atomic Energy Agency to those interested in quality assurance in nuclear medicine. It will include such items as:

(i) reports on training activities, e.g., training courses, workshops, study seminars;

(ii) reports on scientific meetings;

(iii) results of other projects undertaken to investigate or upgrade quality assurance in nuclear medicine;

(iv) progress reports from affiliated laboratories, e.g., WHO Collaborating Centres.

The editors will also consider the inclusion of information relevant to new methods dealing with quality assurance in nuclear medicine.

The Radiation Medicine Unit (Division of Diagnostic, Therapeutic and Rehabilitative Technology) of WHO and the Medical Applications Section (Division of Life Sciences) of the IAEA plan to publish this Newsletter on Quality Assurance in Nuclear Medicine periodically, whenever enough information has been gathered.

Quality Assurance in Nuclear Medicine

G. Souchkevitch, WHO; A. Wegst, IAEA

Quality-control procedures have always been a necessary part of nuclear medicine. From the earliest days of the speciality, it was well recognized that even the simplest of radiation detectors required routine testing if one were to have confidence in the results. As the detectors and associated instruments designed for nuclear medicine (for example, scintillation cameras) became more complex, the calibration procedures likewise became more complex but even more necessary to the correct operation of the instrument. Further, radiopharmaceutical development increased the necessity of additional quality-control procedures within each hospital. Initially, radiopharmaceuticals as purchased were in a form suitable for administration to the patient, the quality control being performed by the manufacturer before shipment. However, the introduction of short-lived radionuclides which were eluted each day from an in-house generator system, and were subsequently used to label an appropriate compound, required further quality-control procedures to be carried out routinely both on the eluate from the generator and on each final product.

The widespread growth of nuclear medicine in developed and developing countries has led to an intensive effort by manufacturers of nuclear medicine instruments and of radiopharmaceutical kits to simplify extremely complex systems so that even a poorly trained person can operate them. Unfortunately, one effect has been to obscure the need for quality control. The question so often asked is, "How could such an expensive, sophisticated but easy to use scintillation camera need daily checking?"; or "How could this well-designed $^{99}Tc^{m}$ generator not produce a high quality product?". The improved performance of instruments through better design and incorporation of modern electronic circuits has not changed the basic rule: Every radiation detector requires routine testing. Neither does a streamlined radiopharmaceutical production system lessen the need to test the final product administered to the patient.

In order to maintain quality and confidence in any nuclear medicine department, it is imperative to implement a Quality-Assurance Programme. Quality assurance designates all those actions that are necessary to provide adequate confidence that a system will perform satisfactorily. To a nuclear medicine physician, this means consistently obtaining adequate diagnostic information at a minimum of cost and risk to both patient and staff. Quality assurance (the overall task) requires specific sets of quality-control procedures (the component elements of the task) which must be carried out routinely to maintain or improve quality. These procedures can be specified for each stage of the diagnostic process, for example, handling of patients, use of instruments, preparation of radiopharmaceuticals, evaluation of test results, determination of normal ranges, and keeping of records. Such a program requires the positive endorsement and budgetary support of the department head, adequate environmental conditioning and maintenance of the equipment, and careful planning and continued monitoring by the entire staff.

The International Atomic Energy Agency has always had a firm commitment to quality control in nuclear medicine. Over the past six years, a number of specific projects have been initiated by the Agency in order to concentrate awareness, teaching efforts and other resources in this area.

One of the first products was a Guidebook, sponsored by the Agency in collaboration with WHO and written by K. Kristensen, entitled "Preparation and Control of Radiopharmaceuticals in Hospitals" (Technical Report Series No. 194, IAEA, Vienna, 1979).

The Agency is aware that quality control of nuclear medicine instruments in developing countries is in general not being implemented and that there has been no general consensus, within the nuclear medicine community, as to the identity or frequency of the tests to be performed. To address these issues an IAEA Advisory Group on the Quality Control of In Vivo Radionuclide Procedures was convened (with WHO participation) in Vienna from 27 to 31 August 1979. The physicists and physicians attending drafted general recommendations for the quality control of various classes of nuclear medicine instruments. These recommendations were further discussed and modified at the IAEA International Conference on Medical Radionuclide Imaging held in Heidelberg, Federal Republic of Germany, from 1 to 5 September 1980.

Further, in order to provide direct assistance to the nuclear medicine facilities in the developing countries, two Regional Technical Cooperation Projects were initiated by the IAEA, one for cooperating countries in Latin America and one for cooperating countries in Asia and the Pacific. Seminars and Workshops have been held in each Region to stimulate implementation of quality-control procedures for nuclear medicine instruments. These activities are summarized in a separate report in this Newsletter.

The Workshops emphasized the need for a procedural manual detailing each test. To address this issue a second IAEA Advisory Group on the Quality Control of Nuclear Medicine Instruments met in Vienna from 15 to 19 November 1982, and provided (again with WHO participation) a greatly expanded version of the recommendations drafted in 1979. This was published in 1984 with the title Quality Control of Nuclear Medicine Instruments (IAEA-TECDOC-317). It is discussed further in an accompanying article in this Newsletter.

In the Agency's programme, implementation of quality-control procedures continues to be encouraged within each country by several mechanisms. Among the most important are coordinated research programmes in the two regions of Latin America and of Asia and the Pacific. The principal investigator in each participating country, carrying the essential test devices and sources, visits nuclear medicine laboratories throughout the country to assist performance of the stipulated quality-control tests, to collate information on the performance of instruments, and to encourage laboratories to acquire their own sets of test devices and sources. Other mechanisms include the provision of training and experts under the Agency's technical cooperation programme. This stimulation of quality control of instruments is coupled with an active Agency programme for organization and training in instrument maintenance with the intention that cost-effective means be available to correct defects in performance that may be discovered. The IAEA, in co-operation with WHO, organized an international symposium on Nuclear Medicine and Related Medical Applications of Nuclear Techniques in Developing Countries, Vienna, 26-30 August 1985. The state of many of these activities was reviewed therein.

WHO initiated activities in quality assurance with a workshop (including Agency participation) held in Heidelberg, Federal Republic of Germany, in November 1980. This workshop was organized jointly by WHO and several institutions in the Federal Republic of Germany: the

Institute of Nuclear Medicine, German Cancer Research Centre; the Institute of Radiation Hygiene, Federal Health Office; and the Society for Radiation and Environmental Research. Its report (Quality Assurance in Nuclear Medicine, WHO, Geneva, 1982) was published as a guide for the development of quality-assurance programmes, and constitutes the first step in the implementation of this activity. A second Workshop concerning this problem was held in Neuherberg, Federal Republic of Germany, in 1983, again with Agency participation. The latter is described in more detail in a separate article in this Newsletter.

WHO also conducted during 1981-1983 an interlaboratory comparison of nuclear medicine imaging devices in 12 European countries, using anthropomorphic phantoms of various designs. The project, and the results it yielded, are described in another article in this Newsletter.

Using the experience gained from this first interlaboratory comparison, WHO and the IAEA are planning an extension of this investigation. Phantoms similar to some of those used in the European study have been constructed by the IAEA, and these "IAEA-WHO phantoms" are being circulated among laboratories in many developing countries. This project is intended to stimulate awareness of the need for quality control, and thereby to motivate every individual laboratory to put into practice the routine quality-control measures recommended in IAEA and WHO publications mentioned above.

As a further aid to all activities in this programme, both the IAEA and WHO continue to collect information on the state of existing nuclear medicine services throughout the world.

The Results of the First WHO Interlaboratory Comparison of Nuclear Medicine Imaging Devices

N.T. Racoveanu, WHO; G.N. Souchkevitch, WHO

The first WHO intercomparison on image quality in nuclear medicine was carried out in 1981-1983. Sixty-eight laboratories from 12 European countries took part in the interlaboratory comparison, using a CAP brain phantom and a CAP liver phantom (College of American Pathologists), and two London liver phantoms (Westminster Hospital, U.K.). The CAP brain phantom had 13 lesions of different sizes (4 to 20 mm diameter) with a target to background ratio of 1.7:1 and was designed for the determination of target-size detectability. The CAP liver phantom with 8 targets of 16 mm diameter and a varying target/background ratio of 0.72:1 - 0.91:1 was aimed at determining the contrast detectability. The London liver phantoms provided were colour coded green and red and each of them had three targets. The target diameters of the red-coded phantom were 1 cm, 1.5 cm and 1.5 cm and were designed to be at the very limit of detection with current gamma cameras, such that the probable "clinical report" on the scintiphotos from this phantom would be "normal liver". The target diameters of the green-coded phantom were 1 cm, 2 cm and 2.5 cm such that the expected "clinical report" for this phantom would be "abnormal" and that estimates of lesion sizes could be made.

Ninety-five studies have been performed with CAP brain phantoms, 94 with CAP liver phantoms. A total of 157 imaging devices were tested, of which only 15 were linear scanners, the rest being gamma cameras mostly purchased after 1975. In 38 studies computer enhancement of the image was used.

The organization of the field work was undertaken by appointed country-coordinators in conjunction with the staff of the participating laboratories who actually performed the imaging procedures. Individual laboratories were instructed to image the phantoms as if they were clinical patients and to complete a data form describing the imaging instrument (gamma camera or rectilinear scanner) and the imaging technique.

The results of the intercomparison showed that the small targets (4-6 mm) were rarely identified and no laboratory detected all 13 targets presented in the CAP brain phantom. Regarding the CAP liver phantom all 8 targets were detected in 29% of the studies. In the majority of laboratories 6-7 targets were detected and in only 13% of the studies were 5 or fewer targets identified. This means that the gamma cameras tested performed better in the detection of contrast than in the detection of targets of small size. For a contrast of 0.72/1 or 0.77/1 the detectability was 92-96%; for 0.84/1 it was 82-91% depending on the location of the target and for 0.91/1 it was only 56-60%. For a target of diameter 16-20 mm the detectability was 92-96%; for 11-14 mm it was 88-90%; for 10 mm it was 80%; for 9 mm it dropped to 64-67%; for 6 mm it was 16-48%; and for 4 mm targets it was 13-16%; all depending on the target location within the phantom. On average 1 false positive and 6 false negative results were reported by participants using CAP brain phantoms and 1 false positive and false negative result using CAP liver phantoms.

Testing of London liver phantoms consisting of tissue-equivalent rubber models of an abdomen gave the following data. A 1 cm target in the green-coded phantom was never visualized. Two targets in this phantom were identified correctly in 34% of the examinations and one target in 52%.

Equivocal and false-positive targets in the green-coded phantom were detected in 42% of the tests. For the red-coded phantom, with its smaller target sizes, the "liver" was usually reported as normal with no target present, although in 11 of the 62 studies 1 target was correctly detected.

The first WHO interlaboratory comparison of performance of nuclear medicine imaging devices has provided an opportunity to study the level of total performance in brain and liver imaging in participating countries and to plan a programme aimed at expanding the investigation to additional countries. The study had a significant effect in establishing, or improving existing, quality-control programmes, and served as an educational aid to improve performance in individual laboratories.

Quality Control of Nuclear Medicine Instruments (IAEA TECDOC-317).

A Technical Document issued by the International Atomic Energy Agency, Vienna, 1984.

E.H. Belcher, IAEA; A. Wegst, IAEA

It is now widely recognized that the attainment of high standards of efficiency and reliability in the practice of nuclear medicine, as in that of other specialities based on advanced technology, requires an appropriate quality-assurance programme. Quality control of the various electronic instruments used for radiation detection and measurement constitutes a highly important component of any such programme. The document under review, which gives detailed guidance on the quality control of these instruments, stems from the work of two Advisory Groups convened by IAEA, the first in 1979 and the second in 1982. It is available free of charge from the Medical Applications Section, IAEA, A-1400 Vienna, Austria.

The opening chapter of the document presents general considerations relating to the quality control of nuclear medicine instruments. A fundamental principle in such control is that it should be undertaken as an integral part of the work of the nuclear medicine unit, and by members of the unit staff. This has the virtue of developing in the users an awareness of the principles of quality control. The quality control of each instrument should have as its starting-point the selection and acquisition of the instrument itself, since instruments may differ widely in performance. The choice of an appropriate site for installation of the instrument should likewise be considered within the scope of quality control, in as far as it may influence performance.

Once received and installed, an instrument should be submitted to a series of acceptance tests designed to establish whether its initial performance conforms with the manufacturers' specifications. No instrument should be put into routine use unless it has been shown through acceptance testing to be performing optimally. An instrument that does not perform correctly at installation has a high likelihood of never doing so. At the time of acceptance testing, reference tests should be carried out to provide data against which the subsequent performance of the instrument can be assessed by routine testing at regular intervals. Finally, operational checks, carried out each day the instrument is used, should be put into force. Careful records of the results of all these tests should be kept and, if these reveal unsatisfactory performance, appropriate corrective action should follow.

Such quality control does not, of course, obviate the need for the usual preventive-maintenance procedures, which should still be carried out on a regular basis. Maintenance procedures are intended to put an instrument into the best possible working condition, but they cannot guarantee that it remains so, nor that it is correctly used in a given procedure. Quality control gives the users confidence in the latter respects. On the other hand, while quality control may show that a failure has occurred, it rarely provides the exact diagnostic information needed for repair. A close liaison between the persons involved in the two activities is thus indispensable and should commence with the acceptance testing of the instrument. Certain tests used in quality control may have to be repeated during preventive maintenance or after corrective maintenance for the repair of a failure. It is then very important that these tests are always carried out according to the same protocols and that their results are always compared with the reference data.

It is emphasized that the success of such a scheme depends on its being understood and accepted by all concerned. It further requires a clear definition of responsibilities, strict adherence to test schedules and protocols, and proper facilities for the follow-up of test results. The desirability of links with national atomic energy and health authorities, professional associations and working groups, and instrument manufacturers and their agents is recognized, but it still rests with the individual nuclear medicine unit to set up a scheme appropriate to its needs.

The chapters that follow constitute specific recommendations for the quality control of radionuclide "dose" calibrators (activity meters), manual and automatic counting systems for gamma-radiation measurements in vitro, single and multi-probe counting systems for gamma-radiation measurements in vivo, rectilinear scanners and scintillation cameras. For each class of instruments, after an introductory summary of their main features, a schedule is presented listing the recommended acceptance tests, reference tests and operational checks, and giving suggested frequencies for the repetition of reference tests in routine quality control. Protocols for the various tests and checks follow, each protocol giving full information as to the radiation sources, radioactive materials, phantoms and other materials needed, the procedure to be followed, the analysis of the data, the interpretation of the results and the limits of acceptability for the latter. It is emphasized that the schedules and protocols are intended for guidance only. The choice of tests and the frequencies with which they are carried out have to take account of the situation in the individual nuclear medicine unit and the status of its instruments. Furthermore, it is not possible to draw up detailed protocols appropriate to all instruments in a given class. Nuclear medicine units should, therefore, modify the given schedules and protocols to suit their individual instruments. What is indispensable is that once appropriate individualized schedules and protocols have been agreed, they should be strictly followed.

The document should be of value to all nuclear medicine units, particularly those in developing countries, in the initiation or revision of schemes for the quality control of their instruments. Its recommendations have provided the basis for instruction in two IAEA regional technical co-operation programmes in the subject field, one initiated in 1980 for countries of Latin America and one initiated in 1981 for countries of Asia and the Pacific.

IAEA Regional Technical Co-operation Projects on the Quality Control of Nuclear Medicine Procedures in vivo

E.H. Belcher, IAEA

Two IAEA Regional Technical Co-operation Projects on the Quality Control of Nuclear Medicine Procedures in vivo are current, one for countries of Latin America initiated in 1980 and one for countries of Asia and the Pacific initiated in 1981. These projects have as their objective the dissemination of sound quality control practice in nuclear medicine throughout the regions concerned, particularly as regards the quality control of nuclear medicine instruments.

Each project started with a Regional Seminar on Quality Assurance in Nuclear Medicine, held in the former case in collaboration with the

Pan-American Health Organization in Bogota, Colombia, in May 1981 and in the latter in Bangkok, Thailand, in July 1982. These seminars, each one week in duration, were attended by medical engineers and physicists, physicians and other specialists engaged in nuclear medicine from countries throughout the region. Their programmes embraced the whole field of quality assurance in nuclear medicine, but gave particular emphasis to the quality control of nuclear medicine instruments. Practical work on the latter topic featured importantly in the programme in each case, this being undertaken in the nuclear medicine services of the host institutions - the Central Military Hospital, Bogota, and the Siriraj Hospital and Medical School, Bangkok.

Subsequently, the projects have been advanced mainly through a series of national workshops on the quality control of nuclear medicine instruments. Eight such workshops have so far been held under the project for Latin America, these having been in Brazil (September, 1981), Mexico (March, 1982), Uruguay (May, 1982 and December, 1984), Ecuador (June, 1982), Costa Rica (February, 1983), Peru (March 1983) and Chile (June, 1985) and five under the project for Asia and the Pacific, in the Philippines (January, 1983), Malaysia (January, 1983), Bangladesh (November 1983), Republic of Korea (August, 1984), and Indonesia (April, 1985). Others are under consideration.

Each workshop, three to four days in duration, has been attended by about fifteen participants: medical engineers or physicists, physicians, and other specialists or technologists engaged in nuclear medicine. Three or four invited experts have assisted in each and the programmes have comprised lectures by these experts and local specialists, discussion periods and practical work in local nuclear medicine services. Lectures have embraced the general principles of quality assurance and quality control in nuclear medicine, the siting, installation and acceptance testing of nuclear medicine instruments, problems of instrument maintenance in nuclear medicine, the principles of operation and the regular quality control of different classes of nuclear medicine instruments - radionuclide (dose) calibrators, counting systems for radioactivity measurements in vitro and in vivo, rectilinear scanners and scintillation cameras - and, finally, the keeping of relevant records. For the practical work, it has been convenient to divide participants into small groups working in rotation on different instruments.

One complete set of radiation sources, phantoms and other quality-control devices for nuclear medicine instruments has been provided under the project to each country where a workshop has been organized, for use during the workshop and retention thereafter. Further such devices are being provided on an individual basis according to particular needs.

It is hoped that the workshops will be repeated on a regular basis by the countries concerned and will give a needed stimulus to the improvement of instrument quality control in nuclear medicine.

Activities under the projects are continuing. Experts have visited for a period of about two weeks to a month each of seven countries participating in the Regional Projects, with emphasis on further stimulating the practice of quality control as recommended in the workshops. Related assistance using other mechanisms, including coordinated research programs, training, and national technical cooperation projects, pursues the same objectives. Experience to date shows that much encouragement through these various channels will be required to establish sound quality assurance as a routine practice in individual laboratories.

The Joint WHO/Institut für Strahlenhygiene (FRG) Training Workshop on Quality Control in Nuclear Medicine held in Neuherberg, Munich 23-30 November 1983

H.D. Roedler, Institut für Strahlenhygiene, FRG; G.N. Souchkevitch, WHO

The objective of the Workshop was scientific exchange concerning the appropriate training and the practical application of quality assurance in nuclear medicine, aimed at avoiding unnecessary radiation exposure of the patient.

This Workshop was for medical specialists and medical physicists from European countries. Based on the recommendations of the previous WHO meeting on this subject held in 1980, selected quality-control procedures were performed and reviewed once more, in order to evaluate their effectiveness and practicability, taking into account recent progress made during the past three years in nuclear medicine procedures and techniques.

The Workshop included introductory lectures on quality assurance in medical care in general and nuclear medicine in particular; WHO's activities in the field of quality control of nuclear medicine; the influence of quality assurance on medical diagnosis; quality control in nuclear medicine instrumentation (the medical physicist's viewpoint); the IAEA's recommendations for quality control of nuclear medicine equipment; and quality control in nuclear medicine with special reference to the nuclear medicine computer.

After a series of lectures providing a general overview of the subject, practice sessions were given on quality-control procedures for scanners and gamma-cameras including SPECT and quality-control procedures for dose calibrators, uptake probes and radiopharmaceuticals.

The result of the Workshop was the formulation of a revised concept of quality control. The participants at the Workshop suggested that a simple total-system quality-control test be applied on a frequent (daily) basis. Any deviation in the results of such a test from the accepted norm would require further investigation and decision trees could be applied to localize faults. Infrequent quality-control procedures serve no useful purpose if the total sytem test continues to function according to established standards. Such tests should be done annually as post-service checks to verify that system performance has been restored.

The section of the publication "Qualtity Assurance in Nuclear Medicine", World Health Organization, Geneva 1982, relating to single-photon tomography and data-handling systems was also reviewed and revised in the light of more recent experience.

Training Workshop on Quality Assurance in Nuclear Medicine
Kuwait, 9 - 13 December 1984

H. Abdel-Dayem, Department of Radiology and Nuclear Medicine, Kuwait University; A. Modjtabai, WHO, Eastern Mediterranean Regional Office, Alexandria; G. Souchkevitch WHO

The workshop, sponsored by the World Health Organization's Eastern Mediterranean Regional Office and the Ministry of Public Health, Kuwait, was held at the Faculty of Medicine and the Mubarak Al-Kabeer Hospital, Kuwait. There was a total of 34 participants of whom 18 were nominated from 10 countries (Cyprus, Egypt, Iraq, Iran, Kuwait, Lebanon, Pakistan, Saudi Arabia, Sudan, Tunisia).

The main goal of the workshop was to offer to the participants information on basic principles of quality assurance in nuclear medicine, and practical training on how to perform the routine tests of quality control in nuclear medicine facilities. This goal was reached.

The workshop was divided into two main areas: 1) lectures given in the mornings and 2) practicals in the afternoons. The lectures and the practicals were co-ordinated and complemented each other. The lectures included quality assurance on instruments (rectilinear scanner, gamma camera, SPECT, dose calibrator, well counter, thyroid up-take probe and survey meter) and radiopharmaceuticals. Several lectures were dedicated to radiation protection in nuclear medicine, roles of the World Health Organization and the IAEA in nuclear medicine and nuclear-medicine quality assurance in developing countries.

The practicals covered routine quality control in nuclear medicine with emphasis on tests to be done daily, weekly, monthly, quarterly and annually. The workshop emphasized that for quality assurance in nuclear-medicine facilities of developing countries, it was necessary first to ensure the availability of:

i) constant supply of electricity
ii) well-trained personnel and appropriate workload
iii) appropriate equipment
iv) service engineers and spare parts.

In the practicals, quality-control tests of gamma cameras, SPECT, dose calibrators, up-take probe, survey meters, computers and radiopharmaceuticals were performed.

One of the essential parts of the organization of the workshop was its evaluation by the participants and lecturers. The following suggestions were made:

1. supervisors and technologists who actively perform quality-control procedures in a nuclear-medicine facility should participate in the workshop;

2. the programme of the workshop should be sent to participants in advance;

3. the duration of the workshop should not be less than 7 days if instrumentation and radiopharmaceuticals are combined;

4. participants should be given more opportunities to do practicals; practicals should receive more emphasis than lectures;

5. more time should be allotted to quality control of radiopharmaceuticals;

6. quality assurance of radioimmunoassay should be included in the practicals.

The workshop was well organized. The participants felt that they learned useful quality-control tests that they would perform on return to their laboratories.

The organization of such workshops in different areas on an international basis is very important for establishing Quality Assurance in nuclear medicine in developing countries.

WHO Collaborating Centres in the Field of Nuclear Medicine

G.N. Souchkevitch, WHO

To carry out specific tasks in the field of nuclear medicine, WHO designates Collaborating Centres in various countries throughout the world. The centres assist WHO and the IAEA in the promotion and improvement of general nuclear medicine.

During the last five years the WHO Collaborating Centres named below have taken an especially active part in a number of WHO-IAEA activities which have played an important role in the progress of nuclear medicine services.

WHO Collaborating Centre for Nuclear Medicine (Institute of Nuclear Medicine, German Cancer Research Centre, Heidelberg, FRG) (in collaboration with the IAEA) assisted WHO in the organization of a Workshop on Quality Assurance in Nuclear Medicine (1980) and in the publication of a guide prepared following the Workshop.

WHO Collaborating Centre for Nuclear Medicine (National Center for Devices and Radiological Health, Rockville, USA) has assisted with the development of WHO and IAEA international quality-control programmes for nuclear medicine. The Centre has continuously provided WHO with valuable information and expertise on various aspects of nuclear medicine equipment, procedures and radiopharmaceuticals.

WHO Collaborating Centre in Nuclear Medicine (Department of Laboratory Medicine, Danbury Hospital, Danbury, USA) was one of the organizers of the first WHO Interlaboratory Comparison in Europe (1981-1983) on performance of nuclear medicine imaging devices.

WHO Collaborating Centre for Nuclear Medicine (Radiopharmaceuticals), the Isotope-Pharmacy, National Health Service of Denmark, prepared (in collaboration with the IAEA) a guidebook (1979) "Preparation and Control of Radiopharmaceuticals in Hospitals", and has assisted in training activities of WHO and IAEA.

WHO Collaborating Centre for Nuclear Medicine (Department of Medical Radiology, Central Institute of Advanced Medical Training, USSR) in collaboration with IAEA, has organized a yearly Interregional Training Course and Study Tour on Nuclear Medicine.

WHO Collaborating Centre for Nuclear Medicine (Department of Nuclear Medicine, The Prince of Wales Hospital, Australia) assisted in the collection of information on the state of existing nuclear medicine services in Australia and neighbouring countries.

WHO Collaborating Centre for General Nuclear Medicine (Radiation Medicine Centre, Bhabha Atomic Research Centre, India) assisted in the collection of information on the state of nuclear medicine services in India, and participated in WHO-IAEA activities aimed at the optimal use of nuclear medicine equipment and techniques in developing countries.

Recent Publications on Quality Assurance in Nuclear Medicine.

1. K. Kristensen, Preparation and Control of Radiopharmaceuticals in Hospitals, Technical Reports Series No. 194, International Atomic Energy Agency, Vienna, 1979.

2. Medical Radionuclide Imaging, Proceedings of a symposium organized by the IAEA in cooperation with WHO, Heidelberg, 1-5 September 1980, Vol. I, II, International Atomic Energy Agency, Vienna, 1981.

3. Quality Assurance in Nuclear Medicine, World Health Organization, Geneva, 1982.

4. Quality Control of Nuclear Medicine instrumentation, R.F. Mould (ed.), The Hospital Physicists' Association, London, 1983.

5. V. Volodin, G. Souchkevitch, N. Racoveanu et al., World Health Organization inter-laboratory comparison study in 12 countries on quality performance of nuclear medicine imaging devices, Eur. J. Nucl. Med. 1985, 10, 193-197.

6. Quality Control of Nuclear Medicine Instruments, IAEA-TECDOC-317, International Atomic Energy Agency, Vienna, 1984.

7. Nuclear Medicine and Related Radionuclide Applications in Developing Countries, Proceedings of a symposium organized by the IAEA in cooperation with WHO, Vienna, 26-30 August 1985, International Atomic Energy Agency, Vienna, 1986.

NEWSLETTER: IAEA/WHO QUALITY ASSURANCE PROGRAMMES IN NUCLEAR MEDICINE
DIVISION OF LIFE SCIENCES
INTERNATIONAL ATOMIC ENERGY AGENCY
WAGRAMERSTRASSE 5, P.O. BOX 100
A-1400 VIENNA, AUSTRIA

Printed by the IAEA in Austria
May 1986

86-02073