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# **Radiological Protection of Patients in Diagnostic and Interventional Radiology, Nuclear Medicine and Radiotherapy**



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## **RADIOLOGICAL PROTECTION IN MEDICINE: CURRENT PROBLEMS IN INDONESIA**

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### **Abstract**

Radiological Protection in Medicine: Current Problems in Indonesia. The medical applications of ionizing radiation in Indonesia have been introduced in the early 20th century. Since then it dominates the application of radiation in various fields. By several regulations, the government has tried to control these applications. However, some problems are still persisting. This paper presents the safety-related regulations that in place in Indonesia, authorization status regarding medical applications, the existing problems and the efforts to tackle them. Eventhough the funds are always the scapegoat, it is believed that the real reason for all problems concerning radiation protection in Indonesia is lack of safety culture among the users.

### **1. Introduction**

A German-born Dutch physician introduced the first use of atomic energy in Indonesia in the early 20th century. During the first five decades, the peaceful uses of atomic energy in this country had been dominated by x-ray radiation for medical purposes, both diagnostic and therapy. In the 1960s, this was followed gradually by the use in research and agriculture. The last two decades saw the rapid growth of these uses, including in industry, research, agriculture, and education, as well as in hospitals.

Despite its rapid growth in various aspects, the potential hazard of the use of atomic energy has also been realized from the very beginning. As a matter of fact, activities in radiation safety in Indonesia have been initiated as early as in the middle of 1950s. In recognizing the need to carry out research on the effect of radiation on man in the light of the bombing of Hiroshima and Nagasaki with atomic weapon, the government at that time established the Committee for Study on Radioactivity.

The highest regulations concerning the execution of the use and control of nuclear energy in Indonesia at present is Act No. 10 Year 1997 on Nuclear Energy. This Act supersedes the Basic Stipulations of Atomic Energy Act of 1964 which was then found to be inappropriate due to the development in times and continuing progress in science and technology in the use of nuclear energy.

Article 16 of the 1997 Act states that any activity related to the utilization of nuclear energy shall maintain the safety, security, peace, health of the workers and the public, and protection of the environment. According to this article, therefore, the safety provisions need to be further regulated, including the provision for radiological protection in medicine.

The new Act also separates the authority in executing and controlling of nuclear energy into two different institutions to avoid the overlapping of activities on the use and control, as well as to optimize the control of nuclear energy in order to improve nuclear safety. The function of execution is given to an executing body, which is called the National Nuclear Energy Agency (BATAN), whereas the function of control is given to a regulatory body called the Nuclear Energy Control Board (BAPETEN).

## 2. Regulation

In the regulation system in Indonesia, the government regulation has the second power after the Act. To implement article 16 of the 1997 Act No. 10 of Nuclear Energy, Government Regulation No. 63 Year 2000 has been enacted. This regulation, which stipulates the safety and health against the utilization of ionizing radiation, replaces Government Regulation No. 11 Year 1975 on the Working Safety Provisions against Radiation.

The scope of the government regulation No. 63 Year 2000 includes the requirements for dose limitation system, radiation safety management system, calibration, preparedness and countermeasures for radiological accident. In the radiation safety management system, the owner shall apply and establish radiation protection organization, radioactivity and radiation dose monitoring, radiation protection instrument, health examination of workers, document record keeping, quality assurance and education and training.

Concerning the radiological protection for patient, article 6 of the regulation states that "in applying doses for diagnostic and therapeutic medical purposes, the owner shall consider the patient protection against ionizing radiation pursuant to article 3 item (a) and (c)". Article 3 itself states that "(a) any utilisation of nuclear energy shall produces benefit to offset the radiation harm that it might cause, (b) the radiation dose received by workers or member of the public shall not exceed the dose limit specified by the regulatory authority, and (c) any utilisation of nuclear energy shall be designed and radiation sources shall be designed and operated so that the magnitude of radiation exposures be kept as low as reasonably achievable".

Concerning calibration, article 30 clause (1) and (2) of the regulation states that "the owner shall calibrate its radiation survey instrument regularly at least once a year" and "the owner shall calibrate its radiotherapy machine output regularly at least once in two years". Further guidance has been enacted in 1991 by BATAN before BAPETEN was established. Director General of BATAN Decree No. 84 Year 1991 regulates the responsibility of the owner concerning calibration and radionuclide standardization, level and responsibility of calibration facility, and certification and tag of calibration and standardization. This decree will soon be revised by BAPETEN.

## 3. Authorization status

The authorization system in Indonesia is applying only the licensing scheme. By this scheme, all legal person utilising nuclear energy shall apply for license from the regulatory authority. The license will be granted if the person meet five requirements, mostly related to safety, stipulated in Government Regulation No. 64 Year 2000 on the Licensing for Utilisation of Nuclear Energy. This new regulation replaces the old one stipulated in 1975 (i.e., Government Regulation No. 12 Year 1975 on the Licensing of Radioactive Materials).

In the field of medical, by the end of December 1999 there were 1307 licenses have been granted. These consist of 40 licenses for therapy application (8 linear accelerators, 28 radioisotopes and 14 X-ray machine), 12 for diagnostic application with radioisotopes, 1197 for diagnostic X-rays, and 58 for storage of radioisotopes.

The application of radiation in the field of medical is in fact the highest among other fields. By the end of December 1999, the licenses granted to all other application were 464, consists

of 234 licenses for radiography, 82 for gauging, 21 for logging, 26 for chemical analysis and 101 for various others.

#### **4. The problems**

Problems encountered in radiological protection in the medical application of radiation in Indonesia can be categorised as administrative-related and technical-related. From administrative point of view, as much as 905 licenses for hospitals have been expired by the end of January 1999. In the same time, calibration certificates for output of 19 therapy units have also expired and 11 therapy units were operated without license. In addition, calibration certificates for radiation survey instrument in most hospitals were expired as well, and even some hospitals have no instrument at all.

From technical viewpoint, inspection conducted during 1999 to some hospitals in four provinces revealed that most hospitals have no logbook on the therapeutic irradiation for patient. In addition, record keeping of occupational doses was not maintained and there were no health examination carried out for the workers.

#### **5. Efforts to tackle the problems**

Before BAPETEN was established, control of utilisation of nuclear energy in Indonesia was carried out by BATAN. BATAN and Department of Health were actually set up a Joint Commission in 1991 to tackle the problems encountered in the medical applications of radiation. Every year this commission gave recommendations to hospitals concerning radiation control. The Directorate General of Medical Services of the Department of Health has regularly also released memorandum to hospitals concerning radiological safety. However, all these recommendations made by the Joint Commission, as well as memorandum from the Department of Health, were ignored by most hospitals. The ignorance was thought to be rooted from behaviour, responsibility, communication and administrative bureaucracy. In order to tackle the above-mentioned problems, several efforts have been conducting by the BAPETEN since the middle of 1999. Persuasive approach was started with the hospitals by letters and dialogue, rather with punishment as stipulated in the 1997 Act. This approach was quite successful, since some the hospitals beginning to realize the importance of license and then extended their licenses.

Recently the controlling part of joint commission of BATAN-Department of Health was updated and become an MoU between BAPETEN and Department of Health on building and controlling nuclear energy in the field of medicine. This new joint commission will focus their tasks on calibration of various radiation instruments used in hospitals and other medical institutions, as well as on other safety-related problems.

BAPETEN is at present also developing some safety-related guidance to various applications. Two of them that related to radiological protection in medicine are guidance on dose levels for diagnostic radiology for patient and guidance on safety standards for the application of radiotherapy instrument. These guidances are still in preparation and planned to be ready by the beginning of next year.

The data from Department of Health also revealed that all over Indonesia there are only five radiophysicists, or medical physicists, in duty in hospitals. These medical physicists were not the real ones, since they are actually radiographers that trained specifically in medical physics after working for more than 10 years.

To cope with the lack of medical physicists, Physics Department of the University of Indonesia, in collaboration with Faculty of Medicine, BATAN and Department of Health, since 1998 have been running interest on medical physics. Students must pass 105 credits on physics before voluntarily choosing medical physics. Number of credits to finish study on physics are 144, so that subjects related to medical physics to be passed are 39.

In spite of several actions carried out by BAPETEN, some problems are still persisting. In the calibration of output therapy machine, for example, the one who pay the cost actually government, not the hospitals themselves. When BAPETEN asked the hospitals why they did not calibrate their output machine, they just simply said that they have no money for it. BAPETEN was then asked for extra budget to the government, which luckily agreed, to perform this calibration. What will happen in two years time, when the hospitals need to recalibrate their output and the government has no more money? Fund is also the reason why radiation workers in some big government hospitals are not personally monitored. To make it worse the situation, facility within the Department of Health that gives personal radiation monitoring services is also facing the same problem, not enough funds to monitor all radiation workers in government hospitals.

A medical physicist is known to be needed by hospitals. However, hospitals in Indonesia are still not interested to recruit medical physicist. The tasks of physicists at present are handled by radiographers. The medical physicist who will soon graduate are still not certain whether they can work at hospitals, since it is still not compulsory for the hospitals to recruit medical physicist to perform the physics-related tasks in hospitals.

## 6. Concluding remarks

The problems in radiological protection in medicine in Indonesia are quite complicated. Fund is always the scapegoat for the problems, but it is believed that it is not the real reason. The main reason is thought to be caused by the lack of behaviour and responsibility toward safety, or in short safety culture, among the users, as well as communication between parties involved in the radiation safety and the existing administrative bureaucracy. The government, particularly BAPETEN as the regulatory authority, therefore, shall continuously promoting safety culture and communication to achieve the highest standard in safety among the users of radiation in Indonesia.

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