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RADIATION PROTECTION IN IRAN*

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ABSTRACT

This paper presents the current activities on radiation protection in Iran. According to the Atomic Energy Organization Law of Iran the radiological safety is ascribed to the Atomic Energy Organization of Iran (A E O I) and the Radiation Protection Department (R P D) is the responsible organ within AEOI. R P D since it's establishment in 1975, with the aim to ensure the protection of man and his environment against any harmful effects of radiations, has embarked on a national development and regulatory activity. The organization and the program of the R P D with an emphasis on the problems and achievements are discribed in this paper.

The Iranian Radiation Protection Society and it's cooperation with the R P D for the dissemination of information and support for the educational institutions to cover the radiation protection topics are presented in this paper. It can be shown that countries envisaging to embark on a nuclear development have to start much earlier with a major educational and training activity for the personnel in radiological safety as well as other relevant fields.

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1- HISTORY

Within a short time after the discovery of X-rays by Roentgen (1895) and of radioactivity by Becquerel (1896), the first cases of biological damage due to radiations were observed and the first attempts to protect the man were carried out. The first recommendations on radiation protection were set out in 1921 by the British X-ray and Radium Protection Committee, and, in 1928, the International Commission on Radiological Protection was formed. With the "Manhatten Project" for the development of the first atomic weapon, in 1942, the Radiation Protection was born in the U.S. atomic laboratories as an autonomous discipline and profession.

In Iran organized activity in the field of atomic energy began in 1959 by establishing the Nuclear Research Center of the Tehran University. Health Physics section was formed at the same time. However actual work and film-badge service was initiated and started operation in 1960. Health Physic services was limited at the beginning for the limited personnel of the Nuclear Research Centre and few institutions requesting assistance.

Urged by the increase applications of atomic energy and radiological protection requirements several courses on radiation protection was held and Ministries of Labor and Health have initiated active program in this field.

Ministry of Labor of Iran prepared and issued a regulation for the protection of labor in industries using radioisotopes and radiation producing machines in 1973/1/. This was the first official regulation in this field which was applied in Iran. For the present time the inspection department of the Ministry of Labor of Iran enforces this regulation throughout the country.

Similar efforts have been carried out in the field of medical applications in Iran. Ministry of Health Initiated a radiation protection program throughout the country in 1970. In 1973, the institute for radiation protection was established for the inspection and licensing activities. This included an office with 3 persons (one graduate and two technicians) with surveying and dosimetry equipments in each regional state.

In Tehran a central laboratory and calibration services was provided for dissemination of the required assistance and services. This program has been carried out at the present time and it is envisaged to follow up the program with more coordination and encouragement in the future.

The Tehran University Nuclear Research Center, as an encouraging force in the field of radiation protection, has initiated research and has held several training courses for graduate students. As part

of this program, with the co-operation of the WHO, a regional M. Sc. course on Radiological Health was organized in the Faculty of Public Health of the Tehran University in 1973. The period of this course was two years (with 11 students from several countries) and was succeeded by a second course in Farsi in 1975.

With the establishment of the Atomic Energy Organization of Iran (AEOI) in 1974, a new area in the field of Radiation Protection was created and coordination of a national program was initiated. The function of the AEOI as laid down in the atomic energy organization law of Iran/2/ includes the responsibility for controlling all activities involving radioactive materials and radiation installations throughout the country.

2- SOURCES OF RADIATION HAZARDS IN IRAN

Unsealed radioactive sources mostly short-lived radioisotopes are mainly used for medical purposes. Unsealed sources are also used in research, agriculture, educational institutions and industry. Information from airport customs provide the estimate that the annual rate of increase of usage of radioactive materials is about 30%/3/. Sealed radioactive sources mainly C0-60 are used in teletherapy and industrial applications. There are 11 teletherapy units used in hospitals and clinics in Iran. Small sealed sources are also widely used in medical, research and industrial applications. Miscellaneous sources such as luminous devices, static eliminators, radioactive lightning conductors, etc. are widely used and most of which are available in public.

Radiation producing machines, mainly X-ray equipments, are used similar to the radioactive sources. A 3 MeV Van De Graaf is used for research at the Tehran Nuclear Research Center. Iran has only one 5 MW swimming pool type reactor for experimental use in the Tehran Nuclear Research Center. In the past it was also envisaged to build several nuclear power plants in Iran, which has been stopped according to the present government decisions.

3- FUNCTION OF THE RADIATION PROTECTION DEPARTMENT OF THE AEOI

The responsibilities and authorities of the AEOI arising from the existing laws related to the protection of man and his environment against any possible harmful effects of ionizing radiation are executed by the Radiation Protection Department (RPD) of the

AEOI. The radiation protection program in its broadest sense includes:

— Control of individuals occupationally exposed to ionizing radiation.
— Control of the environment and radioactive waste management
— Control of the members of the public variously exposed to high level background and medical applications
— Control and supervision of importation, distribution, transportation, etc. of radioactive materials and radiation producing machines.
— Control of all radiation installations and nuclear facilities.

It shall be stressed that the primary responsibility for ensuring adequate protection rests with each institute (organization, company, hospital, center, etc.) concerned and it is the duty of the responsible person in each institute to organize appropriate measures and services. The Radiation Protection Department has the responsibility to establish legal framework for ensuring that adequate measures are taken and for taking charge at the appropriate time if an accident occurs giving rise to the release of radioactive material or the irradiation of persons. For ensuring the above tasks the RPD has prepared the following drafts as a base for the national rules and regulations in Iran.

— Basic Radiation Protection Standards and Requirements
— Rules and Regulations for the use of Radionuclides and Radiation Producing Machines
— Rules for Licensing Medical uses of Radionuclides
— Rules for Licensing the Use of X-ray Machines
— Standards on Industrial Radiographic Operations
— Rules for Licensing the use of Particle Accelerators
— Procedures for the carriage of radioactive materials by air in Iran

It is hoped that in the near future the above drafts will be approved by the competent authorities and will be enforced throughout the country.

A major task of the RPD has been the training of its own required staff and a national program for training adequate number of trained manpower in the field of radiological protection. It was recognized from the beginning that the successful application of atomic energy depends strongly upon the success of the training program in Iran. Therefore several short term courses and a 2-year course on a M.Sc. level was conducted.

Co-operation with the faculty of Public Health of the University of Tehran and others were carried out for this purpose. Lack of adequate number of personnel in the RPD has enforced arrangements for

on-the-job training in several European countries. Actual functions and tasks carried out in the RPD can be grouped into the following four topics:

3.1. REGISTRATION, INSPECTION AND LICENSING

Any one who wishes to import, possess, transport, use radio-active sources and radiation producing machines for medical, industrial, educational, research or other purposes has to file an application for a license with the RPD. According to the Atomic Energy Organization Law of Iran /2/, there is no provision for the importation, production, distribution and use of radioactive materials without the prior permission of the AEOI. The Ministry of Economics and Finance has given clear instructions to banks not to open credit accounts against parties dealing with radiation sources without first consulting AEOI. Instruction has also been given to all custom offices in the country and training for the custom officials has been provided. In the field of medical applications, cooperation between the AEOI, the Iranian Medical Council and Ministry of Health has faciliated the speedy issue of both individual and institutional licenses. At the present, 324 radiology and therapy clincis and hospitals, all the 92 nuclear medicine clinics and hospitals and 66 industrial centers using ionizing radiations has been inspected and relevant recommendations and services related to radiation protection has been provided. The documents of over 50 clinics, 150 industrial companies and 10 educational and research institutes have been reviewed for issuance of license in the RPD/4/.

3.2 ENVIRONMENTAL PROTECTION

In order to ensure that radiation exposures to the public are kept as low as it is reasonably achieveable, the RPD has carried out a national environmental protection program. For the above mentioned tasks the following groups were organized:

3.2.1. RADIOLOGICAL SAFETY ASSESSMENT OF NUCLEAR FACILITIES

This group was responsible for the assessment of the licensing documents required for each stage. It includes the assessment of the

competence of the staff to be assigned; and preparation of the environmental statements and safety evaluation reports. For the first two power plants the preliminary stage was executed.

3.2.2. ENVIRONMENTAL MONITORING

This program was considered to consist of three phases: 1) initial phase; 2) preoperational phase; and 3) the final operational phase. The initial phase includes: identification of critical radionuclides emitted by the plant; probable critical exposure pathways in the vicinity of the plant; probable critical population groups; estimation of annual dose received by the population during normal operation of the nuclear power plant; definition of the study area and selection of sample media and development of a sampling and direct measurement mesh. The pre-operational phase was initiated in order to determine the background radioactivity level in the surroundings of the site, establish and checkout sampling methods and procedures and analysis techniques, provide data for calculating radiation dose received by the population due to background radiation prior to plant operation and furnish new input data for improving dose estimates. The operational phase was evisaged to be initiated at the time the plant begins operation.

The experimental studies related to the first site, regarding radioactivity, and radiation measurements, have been performed by the Radioecology and Dosimetry Laboratories of the RPD.

3.2.3. RADIOACTIVE WASTE MANAGEMENT SERVICES

Up to the present, RPD has embarked on a national radioactive waste management program. The first attempt was to make a survey of all the installations which were working with radioactive material and to assess the actual amount of radwaste produced, and to inspect, their temporarily stored facility in each installation.

A waste pick-up service for waste from all radioactive material users were organized and the collected wastes mainly short-lived radioisotopes were temporarly stored in the Nuclear Research Center. Plans were also prepared for a national waste process and storage facility in Iran.

3.3. PERSONNEL SURVEILLANCE

To ensure the protection of workers against harmful effects of ionizing radiations and controlling the accomplishment of the national regulations during normal working conditions, planned special exposures and abnormal situations, RPD has established a national surveillance program and the following services were provided.

3.3.1. PERSONNEL MONITORING

This group and service, initiated in 1960 at the Tehran University Nuclear Center, was transfered to the AEOI in 1974 and subsequently assigned to RPD. This service consisted of a film badge that in 1962 covered only 63 radiation workers but increased before the establishment of the RPD to 2188 persons from 340 institutes. At the present time 4720 persons within 617 institutes are monitored photographic film dosimetry, RPD also is undertaking a program to establish a thermoluminescent dosimetry system for the appropriate applications. Investigations for providing a national neutron dosimetry service has also been initiated in 1976. RPD has also set up a laboratory for the Assessment of doses received by workers from internal contaminations. A radiobiology group was organized for basic research and bio-assay services and a whole-body counter has been purchased for assessing internal contaminations by different radionuclides /4/.

3.3.2 MEDICAL SURVEILLANCE

In order to provide all necessary medical supervision of AEOI radiation workers, a Medical Section was established within RPD in 1976. The main topic was to perform pre-engagement, routine and post-engagement medical examinations of AEOI radiation workers and to ensure their fitness for the specific work and to check and register their condition of health when they change their type of work or leave their jobs. Up to present, over 4600 persons were examined and over 3000 medical registers were set up /4/. Appropriate arrangements with specific medical centers in Iran and France has been made for suitable treatment of workers in case of occurance of over exposure.

3.4. RESEARCH, DEVELOPMENT AND TECHNICAL SERVICES

In order ensure up to date function of the program and develop the required and improved techniques and services, RPD initiated a research and development program /5/, /6/ and has set up various laboratories for the following topics.

- To calibrate and check radiation measurement instruments used for clinical, industrial, research, radiation protection and other purposes.
- To issue certificate for the calibration and checks.
- To keep up-to date on methods and carry out research on the practical applications of radiation metrology.
- To give advice on radiation dosimetry in clinical, industrial, research, radiation protection and other purposes.
- To give advice on selection, use and testing of personnel protection and environmental monitoring devices
- To develop training programs for radiologists, medical physicists, health physicists and others in the field of radiation metrology.
- To provide special services for radiological safety measures in the design and operation of medical, industrial and other institutions.
- To provide electronics and workshop services for RPD.

Some of the above mentioned plans such as initiation of TLD service and neutron dosimetry service and preliminary work for setting up a calibration facility and service has been completed. Others are in planing stage and is hope to be realized in the near future.

4. IRANIAN RADIATION PROTECTION SOCIETY

Urged by the increase use of radioactive materials and radiation producing machines in Iran, the need arose for coordination and co-operation of various disciplines in the field of radiological safety. In 1968 a group of specialists in this field headed by Dr. Parnianpour decided to establish in Iranian Radiation Protection society. On September 23rd, 1968 the first constitution was approved by the general Assembly of the organizing members. The constitution was modified on March 8th, 1978 and approved by the general assembly. The objectives of the society includes:

-To acquaint the radiation workers and individual members of the

public with the radiation protection procedures.

- To assist in the preparation of rules and regulations on radiation protection
- To assist and encourage educational opportunities and scientific research in the field of radiation protection
- To assist in retraining of radiation workers and responsible officers
- To assist and encourage those who study, perform research or work in the field of radiation protection, and
- To organize scientific and technical cooperation with other organizations having similar objectives.

At the present time the society has about 67 members throughout the country. The members are divided into four group (full, Associate, students and Honorary members).

The main task of the society is to disseminate information and to coordinate the task of radiological safety within various governmental and private institutions. Up to present, an excellent cooperation and coordination between Ministries of Health and Labor, Atomic Energy Organization, Universities has been widely encouraged. Cooperation with other societies such as Radiology Society, Nuclear Medicine Society, Nuclear Physics Society has been also established. Application for membership after receiving authorization from the government in 1978 has been forwarded to International Radiation Protection Association. It is hoped, that this will help international cooperation to the benefit of all mankind.

5. SUMMARY

In general it is felt that a suitable base for radiation protection in Iran has been achieved. With the enforcement of the regulations and coordination between various field of activities, the basic requirements will be set.

The main problem related to radiation protection in Iran lies with the required trained manpower in the various disciplines and different levels. There are very limited qualified persons in the field of medical and industrial applications. Coordination between regulatory, user and academic institutions for a training program was found essential. It can be said that a successful use of atomic energy relies heavly on the personnel training program and countries envisaging to embark on such a field have to start earlier with an adequate educational and training activity for the personnel in radiological safety.

The international bodies such as IAEA, WHO, ILO and Societies

such as IRPA can contribute much to this field by organizing or sponsoring training courses of advanced level, aimed mainly at propagating new techniques, for specific roles in radiological safety.

Regarding the Iranian Radiation Society in Iran, it is found that the main task lies in encouraging cooperation between various governmental and private institutions in Iran for a better understanding of the essential role of radiation protection in the present way of life in our country and to establish national cooperation in this field.

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