XA0103003 IAEA-CN-84/70

REGULATORY AUTHORITY INFRASTRUCTURE FOR NAMIBIA

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Abstract. The Republic of Namibia is participating in the International Atomic Energy Agency's Model Project for the Improvement of National Regulatory Authority Infrastructures in Member States. The paper illustrates our experience in solving problems and difficulties confronted in establishing an effective regulatory authority operating within the existing national infrastructure that should be supported by the Government. An effective regulatory authority is seen as part of the wider administrative scope of our Government through ministerial mandates given by the State from time to time, guaranteeing its independence when implementing legal provisions under statutes. Sections of the report illustrate our experience in the following areas:

- National radiation protection policy
- Structure of our national regulatory authority
- Laws and regulations
- Provisions for notification, authorization and registration
- In-depth security measures for radiation sources and radioactive material
- Systems for the inspection of radiation sources, radioactive materials, enforcement of legal provisions.
- Extent of the applications of radiation sources and radioactive materials in the country.

The paper provides information regarding existing Government policy on radiation protection; structure and legal aspects of the national regulatory, including statutes and regulations; the extent of application and uses of radiation sources and security of radioactive materials; human resources: strengths and constraints; management practices and financing of regulatory authority; and plans for emergency recovery of orphan sources.

National plans for management of disused sources, recovery of orphan sources, abnormal emergencies, communication of information to affected persons on exposure effects, and the safety training of persons using these applications are discussed. the paper provides a summary and some suggestions of the way forward for Namibia.

INTRODUCTION

The Republic of Namibia is participating in the IAEA's Model Project for the Improvement of National Regulatory Authority Infrastructures in member States. Significant achievements have been recorded in the past few years, in view of the fact that Namibia has been independent for only ten years.

The IAEA Action Plan was approved by the 43rd General Conference. The objective of the Action Plan is the development and implementation of activities that will assist Member States in maintaining and improving the safety of radiation sources and security of radioactive materials. The information we provide will indicate our efforts in setting up administrative, technical, and managerial mechanisms required to ensure the regulatory control of radiation sources and safety of radioactive materials by our national authority.

NATIONAL RADIATION PROTECTION POLICY

In 1994, the Government of the Republic of Namibia approved the National Policy on Radiation Protection which articulates Government intent on radiation sources and radioactive materials including all matters related to management; peaceful applications of nuclear energy; and most important the regulatory aspect and its organizational structures. The policy set out the requirements for the establishment of an Atomic Energy Board as an independent

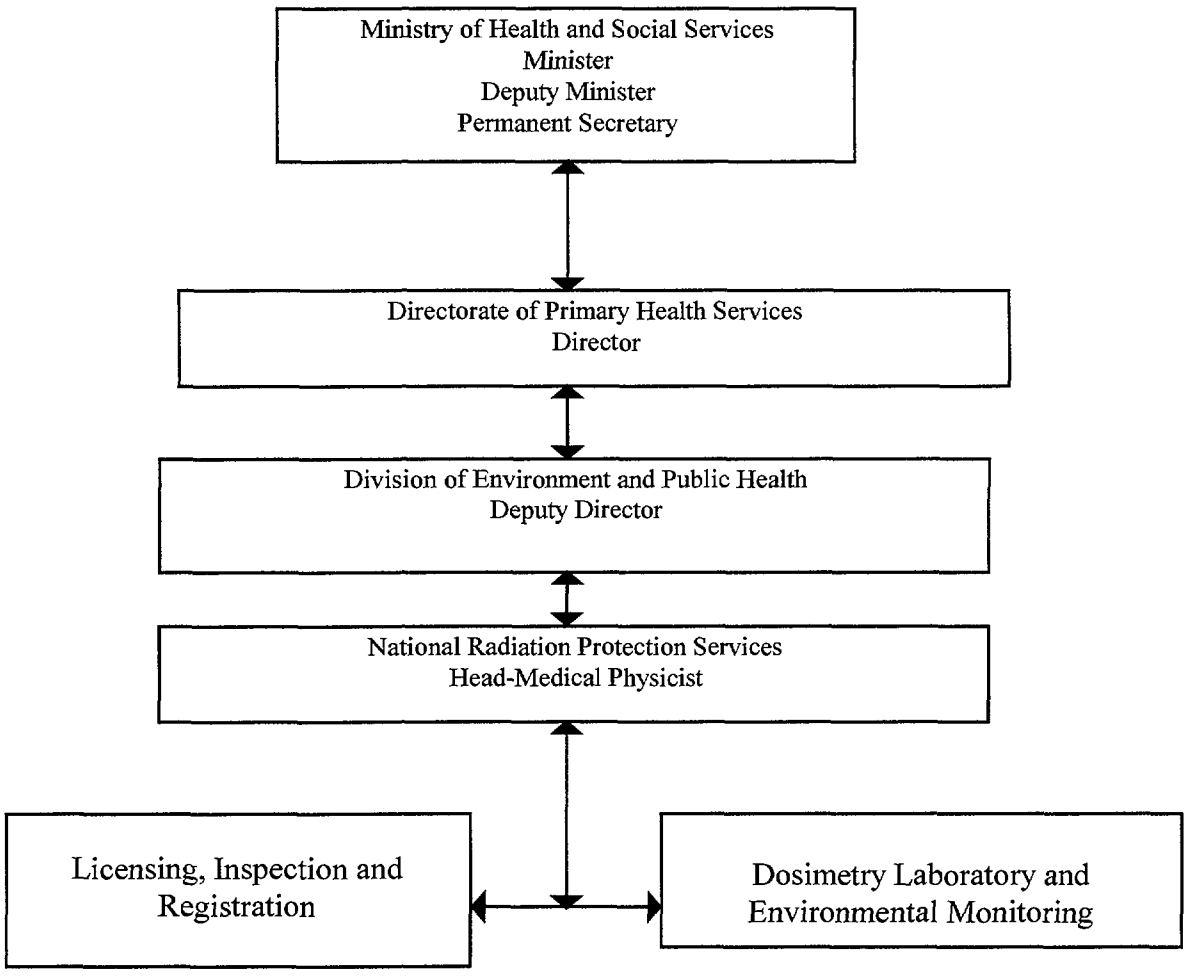
advisory body to the Government on the implementation of the policy and National Radiation Protection Services as the enforcement agent of the regulatory provisions.

The policy further provides that the two regulatory authority bodies be established either by a new law or through regulations. A national policy on the safety of radiation sources and security of radioactive material is a useful managerial tool because through it we will be able to monitor the effectiveness and the rate of implementation of the recommendations of the Agency's Basic Safety Standards and national regulatory mechanisms.

STRUCTURE OF THE NATIONAL REGULATORY AUTHORITY

The national regulatory authority structure was approved by the Government in the national policy. The new law will provide the powers and functions of both the Board and the National Radiation Protection Services, which will act as an inspectorate unit. Currently, there is no provision for the Board are carried out through consultations with relevant stakeholders and the office of the Permanent Secretary.

Table1. Organizational structure of the regulatory authority in Namibia



At the operational level the head of the National Radiation Protection Services is directly responsible to the divisional head for the enforcement of the law. The head of the Unit co-ordinates the activities of the other two sections. Each section is headed by a radiation expert who is supported by two technical officers. The national regulatory authority has provision for seven technical and scientific officers who are supported by other officers from the Administrative Support Services of the Ministry. The new law shall set up an appropriate structure. We hope to exchange views and get ideas at this conference in this area in view of Namibia's industrial, mining and technical applications in the field of radiation sources and safety of radioactive materials. Namibia has one of the largest open pit uranium mines in the world (Rossing Uranium) and we have signed and ratified the safeguards agreement with IAEA. The majority of our nuclear activities are limited to health, industrial applications and mining.

Our broader objective on radiation protection policy in Namibia is to protect human beings (workers, patients, the public) from risks resulting from the harmful effects of radiation sources, while allowing for its beneficial applications in medical, industrial, scientific and other purposes, and protecting the environment from unauthorized disposal of radioactive material.

LAWS AND REGULATIONS

The safety of radiation sources and security of radioactive materials in Namibia is regulated by the Hazardous Substances Ordinance, 1974. This law provides for the Government to promulgate regulations for the control of electronic products as group III and radioactive materials as Group IV. Under the law, electronic products include radiation sources but not radioactive materials. the Regulations for the Control of Electronic Products, 1974, provides the systems for the enforcement of the requirements of the law. We are now promulgating the regulations for control of radioactive materials as provided under Section 3(1)(c) of the Ordinance. Other legal instruments relevant to this area are the Labour Act of 1992, the Regulations Concerning the Health and Safety of Workers at Work Places and the Constitution of the Republic of Namibia. Article 95(1) of the Constitution states that the Government shall provide measures against the dumping or recycling of foreign nuclear and toxic waste on Namibia territory.

The regulations in force also require that all workers be provided with training in radiation safety and radiation monitoring devices. The Diamond Protection Act, 1939, provides for the screening of mine workers with radiation sources. This practice is under our regulatory control for the safety of workers and the public in the mining industry. it is important to note that we have restricted this practice to an exposure unit of 1 mSv (milli-Sievert) per worker per year, which is the same dose assigned for the general public in the IAEA Basic Safety Standards.

PROVISION FOR NOTIFICATION, AUTHORIZATION AND REGISTRATION

The Hazardous Substances Ordinance provides under Section 3(1)(b) for the Government to declare any radiation source as a Group III hazardous substance, while under Section 3(1)(c) any radioactive material is classified as Group IV hazardous substance. The grouped hazardous substances are subject to regulations for their safety and security under the law. The law also stipulates under Section 4 (1) that "no person shall:

(a) use, operate or apply any Group III hazardous substance unless it is registered under Section 5(b) and otherwise than subject to the conditions prescribed or determined by the Permanent Secretary;
(b) install or keep installed any Group II hazardous substances on any premises unless such premises are registered in terms of Section 5(c) and otherwise than subject to conditions prescribed by the Permanent Secretary."

The law goes further and declares that: "the Permanent Secretary may on application in the prescribed manner and on payment of the prescribed fee if any, and subject to the prescribed conditions and such further conditions as the Permanent Secretary may in each case determine,

(a) register any Group III hazardous substance for the purpose of this law,
(b) register any premises as premises on which a Group III hazardous substance may be installed. In our law install includes storage."

The regulations for the safety of radiation sources referred to as Regulations Concerning the Control of Electronic products provide in Regulations II that, no person shall use a listed electronic product is licensed and subject to any conditions imposed by the Permanent Secretary. No person shall use a listed electronic product on any premises unless such premises have been licensed and subjects to any conditions imposed by the Permanent Secretary. No person shall modify or dispose of any licensed electronic product or modify any licensed premises or the layout of equipment, including the electronic products on any premises expect with approval of the Permanent Secretary who shall endorse the relevant license accordingly.

SECURITY OF RADIATION SOURCES AND SAFETY OF RADIOACTIVE MATERIALS

Legal requirements for the provision of measures to ensure the safety of radiation sources and the security of radioactive materials are aimed primarily at the protection of workers, the public and the patients from potentially harmful effects of exposure. However, performance safety indicators for protection against potential exposures call for detailed design analysis of radiation generators, sources and source materials. To this end, the licensee is responsible for the safety of the sources and security of materials under a license which includes liability for any failure to comply with licensing conditions.

All users of radiation sources and radioactive materials are required to notify the authority of their intention to possess, use or install sources or radioactive materials. They are subsequently authorized in a licence and appropriate registration is being done through the use of IAEA Regulatory Authority Information System (RAIS).

We require the licencee, in co-operation with the suppliers, to ensure conformity with the requirement of the law and International Electrotechnical Commission (IEC) and the International Standards Organisation (ISO) in procurement of new sources, and equipment, and in facility design. The regulatory authority has the legal powers to impose local regulatory requirements to enhance the security of sources and materials. Finally, sources and equipment are tested during commissioning and decommissioning to ensure compliance with the standards. With regard to radioactive materials, the provisions of the IAEA's Basic Safety

Standards (BSS) are being applied in our regulatory procedures as they are not covered in the present law. However, this gap will be closed through regulations as provided by the law.

INSPECTION OF RADIATION SOURCES, RADIOACTIVE MATERIALS AND ENFORCEMENT OF REGULATORY PROVISION

Inspection of radiation sources and radioactive materials is carried out by the National Radiation Protection Services inspectors. The law empowers inspectors to enter licensees's premises or nay facility deemed to use or store radiation sources and radioactive materials. They have the authority to seek police assistance in enforcing the provisions of the law and conditions of the licence. The law provides for penalties including fines and imprisonment for failure to comply with the requirements of the law or the licence.

All licence holders are inspected annually in order to monitor compliance with legal provisions, and renewal of licenses is subject to a report from radiation inspectors. The biggest problem facing our country is the lack of sufficient local radiation safety inspectors and local institutions to train them. This is an area where we would like to have bilateral discussions with other countries that have training facilities for such officers so that we may increase the number required to cover the entire country. This is also an area that consumes a large portion of the budget for the regulatory authority because it involves traveling throughout the country to areas with licences. On the one hand, the licence holders are demanding to be inspected in order to meet the requirements of the law. On the other hand the trade unions are exerting pressure on the employers to comply with safety and security of potentially harmful applications.

APPLICATION FOR RADIATION SOURCES AND RADIOACTIVE MATERIALS

PATIENT EXPOSURE IN RADIOTHERAPY

In therapeutic radiation procedures, including teletherapy and brachytherapy, calibration and dosimetry are conducted by or under the supervision of a qualified medical physicist. Theraupeutic exposure is prescribed by a radiation oncologist. In order to ensure safety and protection of the patient,personnel are trained and periodically retrained in this. The main objective is to ensure quality through prevention of failures and errors. High energy radiotherapy, such as cobalt-60, has an independent "fail to safety" system for terminating irradiation and is also provided with safety interlocks designed to prevent the clinical use of the machine in conditions other than those selected at the control panel. Other useful accessories available include a patient dose verification system, patient immobilizers, computerized treatment planning and dosimetry calculations, and facilities for shielding radiosensitive organs such as the gonads, lens of the eye and spinal cord.

OCCUPATIONAL EXPOSURE

The Government is responsible for providing facilities for monitoring occupational exposure. Modern equipment also minimizes occupational exposure risks. For example, in the past, brachytherapy sources were introduced into the patient manually, but now a remote after-loader is used.

In this area we focus on the key statutory provisions on the health and safety requirements that affect the radiation worker. The principle of justification of practices is applied and

supplemented by the as low as reasonably achievable (ALARA) principle. If an employer's objectives are not realized, the business or service could fail, making health and safety concerns academic. Our aim is to ensure that health and safety becomes an intuitive and everyday part of the workplace routine that is an integral part of the job, and not an appendage to it.

MINING INDUSTRY AND EXPOSURE OF MINEWORKERS

Rossing Uranium Limited mines uranium bearing ores by open cast mining and processes them in a mill to recover concentrated uranium oxide, which is exported. The mining and milling of uranium involves potential radiation hazards to the workers and to members of the public, for example through:

(a) inhalation of the by-products of radon gas;
(b) external radiation exposure; and
(c) inhalation or ingestion of dust particles containing by-products of uranium.

Uranium in itself is a chemically toxic element and, in the absence of protection , can damage the kidneys. Radium is deposited in the skeleton and can cause bone cancer. The by-products of radon gas can cause lung cancer. The processing of the uranium bearing ores in the mill results in a slurry of fine particles, known as the tailings. Since the grade of uranium ore processed by Rossing Uranium Limited is very low (0.035), practically the entire quantity mined as ore results as tailings. The tailings are disposed of in an impoundment. Radon gas is emitted from the tailings impoundment.

INDUSTRIAL APPLICATIONS

It is estimated that about 200 nuclear gauges are used in Namibia. A large number of fixed nuclear gauges are used in the mining sector, particularly NAMBDEB, Rossing Urainum Limited and Ongopolo Mining Ltd, for belt mass meters, level gauges, density gauges and calibration purposes. These nuclear gauges contain mainly sealed sources of radioactive caesium. Fixed nuclear gauges containing sealed radioactive americium are used for level control in bottling plants of beverage producers. the nuclear gauges offer many technical and economic advantages. Being non-contact devices, they can be operated unattended in hostile environments (e.g. corrosive, high temperatures etc.). They can be easily incorporated into automated systems, thereby facilitating high throughputs, consistency of product quality and reduction of wastage.

Portable nuclear gauges containing a sealed caesium source are used in the construction sector, for example, to control the thickness and density of bitumen used for surfacing roads. Portable gauges containing other sealed sources are also used in the construction sector to optimize the amount of water used for preparing cement concrete mix. The portable nuclear gauges are used by the Ministries of Agriculture, Water and Rural Development, Works, and Transport and Communications, by municipalities and by a few private construction companies. External exposure is the principal radiation hazard posed by sealed sources contained in the nuclear gauges. However, if the seal id damaged, as is likely during use of portable nuclear gauges in the field, radioactive contamination may occur, which can pose an inhalation/ingestion hazard thereby giving rise to an international radiation hazard.

Table 2. Radiation sources and radioactive materials

1.	Diagnostic X-ray units (Government and private sectors)	• ±200 under license • 1 simulator
2.	Namibia Breweries	• 6 gauges of strontium-90 and americium-241 sources
3.	Rossing Mines	• 36 gauges of caesium-137 • 4 are destined for disposal in RSA
4.	Windhoek Central Hospital Nuclear Medicine Department	• Unrestricted source for in-vivo use
5.	Windhoek Central Hospital Radiotherapy Department	• 1 Theratron-cobalt-60 (8 Kilo-Curie) • 30 pellets of Cs-137 for Ca Cx low dose rate (25 milligram equivalent) • 1 iridium-192 high dose rate generator for Ca Cx • 2 strontium-90 for eye treatment
6.	CT scanners	• 4 in the country
7.	Sources not declared: Ongopolo Mine NAMDEB	• 17 of unknown type • unknown type and quantity

MEDICAL APPLICATIONS

X rays are widely used in medical diagnosis and in dentistry and also as an aid during surgical intervention. There are approximately 180 X-ray units, three radiologists and 200 radiographic assistants and radiographers in Namibia to perform general and specialized radiography procedures. There are three computerized tomography (CT) scanners in private hospitals an done in a government hospital. Radiology plays a vital role in early diagnosis of disease and its management. The use of X rays in medical diagnosis has increased rapidly in the industrialized countries and has become the largest contributor to population dose amongst all human-made sources of radiation.

Nuclear medicine is authorized only at Windhoek Central Hospital. The department has a planner gamma camera and a single photon emission computer tomography (SPECT) gamma camera for on-line data acquisition and processing. A variety of static and dynamic studies on the functioning of different body organs are performed using ready-to-use kits of pharmaceuticals, which are labelled with radioactive technetium. Other radiopharmaceuticals which are used in Namibia include cobalt, gallium, iodine, xenon and thallium.

Radioimmunoassay (RIA) tests are performed in the Medical Laboratory of the Windhoek Central Hospital, using ready-to-use kits and radioactive iodine to determine the levels of hormones, immunoglobulins, vitamins and drugs in serum.

With the development of the petroleum and petrochemical sector, one may envisage increased use of neutron gauges during the exploration and production phase of petroleum and natural

gas. Industrial radiography will be applied on a large scale during the construction of refineries, and in downstream petrochemical plants for the inspection of welding on pipes, storage and process vessels. Nuclear gauges will be used in the petroleum product processing plants, petrochemical plants and liquefied petroleum gas bottling plants. Radioactive tracer techniques may be used to locate leakage in buried pipes and installations.

NATIONAL PLAN FOR MANAGEMENT OF RADIOACTIVE MATERIAL

The Government has established a National Emergency Management Unit. In cases of emergency such as airport accidents involving an aircraft transporting radiation sources or radioactive materials, the national regulatory authority has contacts with the unit and the airport fire and police. The national regulatory authority also assists affected persons by informing them of their rights if there is evidence that the exposures were due to negligence of the license holder and also arranges for medical treatment by radiation oncologists.

As indicated earlier, we are now establishing a system of registering all the radiation sources and radioactive materials in the country. We have not as yet come across orphan sources and should they be found, they will be repossessed and put under the regulatory authority for safe storage or disposal. The regulatory authority has made funs available in the national budget for the training of users in safety. In 2000 alone, more than four such training seminars have been conducted for all the radiographers in Windhoek and in the northwestern regions.

Finally, if an authorized practice or a radiation source within a practice has a potential for accident which may precipitate unplanned exposure to any person or initiate an emergency situation, the licensee is required to have emergency plans as provided under other national laws such as fire service safety at workplaces and as appropriate for the scale of operations. This is endorsed on the license as a contingent condition.