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ATOMIC ENERGY IN AFRICA

(Prepared by the International Atomic Energy Agency)

## ATOMIC ENERGY IN AFRICA

The necessity for nuclear power may appear remote in a continent as rich as Africa in hydro power resources. These resources together with the coal resources and recent discoveries of substantial quantities of oil and natural gas should meet the anticipated power demand in the continent although there may be deficiencies in certain areas. However, advances in applied nuclear energy made during recent years may bring nearer the "break-even" point with conventional energy. A developing country embarking on a new power programme should not consider the atomic energy alternative in isolation, but together with an investigation of the conventional means utilizing coal, oil or hydro. The great capital cost and foreign exchange component of power stations, especially nuclear power stations, make it imperative to examine all alternatives. In carrying out surveys to evaluate the possibility of nuclear power plants, the IAEA approach is on a dual basis - nuclear and conventional aspects being treated together. In the preliminary investigations so far carried out by the Agency in nine countries in Africa, it has been suggested that the problem should be the subject of a separate study within the next three to five years. Such studies might be made, for example, in the coastal region of Kenya, in Liberia, Togo, North Cameroun, Sudan, etc. Although the need for nuclear power in most of Africa may be several years away, the construction and operation of a nuclear power station is a highly technical and complex undertaking, requiring highly specialized personnel, so that in contemplating such an undertaking necessary measures must be taken to prepare in advance an adequate number of engineers who would be capable of further specialized reactor training at available reactor sites.

Two of the greatest needs of Africa are food and water. An increase in agricultural production is particularly necessary in view of the increasing population. Whilst the downward trend of agricultural production in 1961/62 (vide E/CN.14/181) is to be noted, atomic energy in the form of radioisotopes may facilitate understanding of measures required for increasing yields of crops and for affording better animal nutrition. Radioisotopes are being used in long and short-term projects which are designed to remedy the existing situation by increasing yields.

Evaluation of water resources in arid and semi-arid regions by isotopic techniques saves time and money and in certain cases is the only known method. A knowledge of the ground water potential of an area is of prime importance; isotopic techniques can be applied to the determination of characteristics of given ground water reserves. They may be used for the tracing of water to find where it goes and also by using, for example, naturally occurring tritium for determining the age of ground water and the amount stored in a given area. These techniques are being used in Rhodesia and will shortly be introduced in Kenya. It could also prove useful in Ethiopia.

In Northern Nigeria isotope techniques may provide the answer to some problems in an extensive drilling programme for artesian water which is being carried out to develop the water resources for agricultural purposes, particularly cattle raising.

Many regions in Africa suffer from a shortage of drinking water both on farms and in urban areas, research is proceeding on the possibilities of providing the necessary heat from nuclear reactors to evaporation plants for desalination of sea water. This process would operate in areas remote from fuel supplies and, if successful, would materially assist in opening up arid zones.

Prevention of sprouting of potatoes, grain disinfestation and food preservation by irradiation are subjects of considerable current research in the more highly-developed countries. Import of seed potatoes, radiated in centres in Europe to prevent premature sprouting, is being considered in North West Africa. As research progresses, it is to be hoped that these methods and their results can be applied in other regions of Africa. Radiation disinfestation of grain appears to be both biologically and technically feasible as is also the application of irradiation for the prevention of losses in dried fish due to insects, which should be considered in certain parts of Africa, e.g. the Republic of Mali and Uganda. Prevention of spoilage due to early ripening of tropical fruits by radiation is another possible use of atomic energy. Food irradiation is a complex subject, and the IAEA has cautioned against a rapid introduction of these programmes

in the developing countries until the necessary research has developed sufficiently elsewhere. The IAEA is, however, ready to advise on present possibilities and their applications to specific national problems.

Considerable entomological research is proceeding on the African continent. Nuclear techniques are being used in entomological control, for example, in cocoa research in Ghana, and in the Mediterranean region attempts are being made to control the olive-tree fly. The IAEA is studying the potential of, and supporting research into, the possibility that the sterile male technique might be applied to the eradication of the tsetse fly.

In recent years agricultural yields have been increased by the improved use of fertilizers. Research into the best type of fertilizer for a given soil has been facilitated by soil studies utilizing radioisotope tracers for measuring fertilizer uptake efficiency. The use of neutron probes for moisture determination permits simultaneous evaluation of soil moisture economy in the crop produced. These methods have recently been introduced into cotton research in Uganda and related methods will be utilized in soil compaction studies in East Africa. In addition to those countries already utilizing these methods, such as Senegal, Ghana, Madagascar, UAR and Tunisia, they could, with advantage, be introduced and applied to local problems in other countries such as Morocco, Cameroun and the Ivory Coast.

In the work being done to improve health and to combat particular African maladies such as liver cancer, sickle-cell anaemia, protein deficiencies and other nutritional studies and leprosy, atomic energy is being applied increasingly in the larger hospitals and in research institutes. Radioisotope laboratories, diagnostic and therapeutic facilities utilizing radioisotopes are in operation, for example, in the Congo (Leopoldville) UAR, Tunisia, Nigeria and Kenya. Provision is also being made for their introduction into new hospitals and research institutes being constructed under national Development Plans. These facilities require trained personnel, and adequate health and safety measures need to

be prepared and introduced when the equipment is installed. Plans for the utilization of isotopes in medicine and biology must therefore allow time for training of personnel and the introduction of appropriate legislation.

While two-thirds of the population of Africa lives on agriculture, industrial schemes are being introduced on a widening scale. Railway construction is spreading, new ports are being constructed and factories established. In several African countries radioisotopes are being used for industrial purposes, for example, to test cement and building materials and rail tracks, and flow measurements through pipes, etc. Considerable savings may be effected by these means and their use could probably be expanded, particularly in West African countries.

At present there are two research reactors operating in the continent - in Congo (Leopoldville) and the UAR. Two others are under construction in Ghana and South Africa and plans for another are under consideration. These reactors, which can supply the local and regional need for radioisotopes, are primarily used for training and reactor studies. It will be readily recognized that specially trained personnel are necessary for the successful operation of atomic energy programmes. Based on the universities and institutes of higher learning in the various African countries, a limited number of personnel can be trained in the basic nuclear sciences but in the main more specialized training will have to be undertaken overseas in established nuclear centres and universities. Training awards, fellowships, scholarships, grants, etc. are available under bilateral, Foundations and other schemes. In the more specialized atomic energy field they are also available under the multi-lateral programme operated by the IAEA whose programme also embraces, where necessary, the provision of university lecturers and grants for study tours.

In recent years many countries have embarked on programmes designed to collect and analyse samples for the determination of trace amounts of radioactive substances in the biosphere. Considerable advantages follow from such a programme being included in the routine operations of national meteorological services using their fixed and mobile stations.

The IAEA both in the field (in UAR and Sudan) and by analysis of samples at its own laboratory in Vienna, has helped in the development of these services and in carrying out surveys on the radioactive contamination of food.

At present 11 African States are members of the IAEA, namely - Congo (Leopoldville), Ethiopia, Ghana, Liberia, Mali, Morocco, Senegal, South Africa, Sudan, Tunisia and the United Arab Republic. The Ivory Coast has recently sought membership. The increasing role of Africa in the work of the IAEA has been reflected in an amendment to the Statute of the Agency to provide two additional seats at the Board of Governors for the area of Africa and the Middle East. This amendment is expected to enter into force in the near future.

In order to identify the needs of the developing countries in Africa and the manner in which atomic energy may best assist their economic and social development, the Agency has proved the value of sending missions composed of experts in various scientific fields on short visits. 19 countries in Africa have been visited by such missions from the IAEA and in 1964 it is intended that a further mission should visit those countries who express a wish to be included in the proposed itinerary. The programmes which have been developed so far by the governments in co-operation with the IAEA have been based largely on recommendations made by these missions as a result of their visits.

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