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PROGRESS IN PEACEFUL APPLICATIONS OF NUCLEAR ENERGY
DURING THE YEAR 1969/1970

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NEW ZEALAND

NUCLEAR POWER

1. The advent of the off-shore discovery of large quantities of natural gas has caused some changes in the programme of the Power Planning Committee -- the major one being the deferment of the introduction of a nuclear station in favour of a gas-fired station, assuming that satisfactory conditions for the supply of gas will result from negotiations now in progress.
2. The report issued by the Power Planning Committee also stated that it was essential, however, to keep abreast with developments overseas in nuclear power technology. To this end a small section is being maintained by the New Zealand Electricity Department to provide for the ultimate introduction of a nuclear-powered thermal station.
3. Investigations and work relating to the introduction of nuclear power generation which could also apply to other nuclear facilities continue. This includes safety criteria, nuclear law, codes of nuclear shipping, manpower, licensing and other requirements.
4. The recommendations presented to the Government by the New Zealand Atomic Energy Committee on the future organization and role of a central authority to deal with nuclear matters in general and licensing and inspection of nuclear power reactors in particular, are likely to need some modification, taking into account the possible deferment of the introduction of nuclear power generation. However, any time granted by a deferment of the introduction of nuclear power presents a valuable opportunity to become better prepared to meet the problems which will undoubtedly be encountered in the future.
5. Training programmes for specialized personnel will require further consideration, and future training commitments will depend on the outcome of other negotiations mentioned.

SEARCH FOR NUCLEAR MINERALS

6. Uranium exploration has recently been reactivated in New Zealand and the recent moves constitute the major activity since 1962. Airborne radiometric surveys over all known areas of outcropping host rock - the Hawk Crag Breccia - in the period 1967-69 failed to reveal any significant mineralization. However, sampling of outcrops has, during the last two years, been complemented by tunnelling, and drilling is also proposed for late 1970.

7. From radiometric surveys, two localities emerge as having the most potential - Pororari River and Lower Buller Gorge (both in the South Island).

INDUSTRIAL APPLICATIONS

8. The use of radioisotopes and radiation in industry continues to grow. The largest facility in the private sector is a 215 000-curie, cobalt-60 irradiation plant for sterilizing medical supplies for New Zealand hospital dressing packs and disposable items.

9. Operated by the Tasman Vaccine Company, this plant is the largest installation of its kind in the Southern Hemisphere. The company has built up a growing export market and is proving a most valuable asset to the country.

10. The company has established good liaison with the universities, Government research departments and other organizations.

11. The use of radioisotopes for non-destructive testing is undertaken by several organizations. The largest recent undertaking is in connection with natural gas pipelines.

NATIONAL RADIATION LABORATORY

12. The Health Department, through its National Radiation Laboratory, is responsible under the radiation protection legislation for the provision of all services and facilities which help to achieve the purpose of the legislation, i.e. the protection of "the health of persons likely to be exposed to harmful radiation".

13. The legislation serves to ensure that all sources of ionizing radiation in the country are under the control of licensees who are held responsible for their safe use. Licensees are provided with any assistance they may require in the field of radiation physics in the form of a free advisory and measuring service.

The Laboratory maintains New Zealand's primary X-ray measuring standard and other standards for certain radioactive substances. Research and development are also undertaken to ensure accurate measurement and safe use of ionizing radiation for all purposes. Monitoring of radioactive fall-out in New Zealand and the associated Pacific area is on a continuing basis, and measurements of some naturally-occurring radioactive substances in this area are also undertaken.

14. Under agreements made between the Governments of New Zealand and Thailand and the World Health Organization, the Laboratory provides assistance to Thailand in the establishment of the national radiation service of that country. Training courses are also given in New Zealand to groups of professional and technical workers, and radiological safety services are provided to several countries in the Pacific area.

FORESTRY RESEARCH

15. During the last two years the use of radioactive materials and radiobiological techniques in forestry research has expanded considerably. New buildings under construction include a radiochemistry laboratory with improved facilities for autoradiography.

16. The main fields of research are the study of forest products, forest pathology, protection forestry, production forestry and the use of carbon-14 for tracer techniques in tree physiology; work on the biochemistry of herbicides and pathology is expanding. A completely new field of work at the Forest Research Institute is that of using carbon-14 labelled compounds to study wood formation at cellular and intracellular levels. Phosphorus-32 is used in various research projects and has been used to study the physiology of root grafts in forest stands and its significance in tree nutrition.

AGRICULTURAL RESEARCH

17. At the Animal Research Centres of the Department of Agriculture at Wallaceville and Ruakura, studies are being undertaken in experimental pathology, cellular events in immunological 'memory', biochemistry of selenium, facial eczema, ruminant nutrition, phosphate fixation in soil and other research projects in animal research.

18. The Applied Biochemistry Division, the Entomology, Grassland and Plant Diseases Divisions, and the Plant Physiology and Soil Laboratories of the Department of Scientific and Industrial Research (D.S.I.R.) conduct investigations and undertake research in a very wide range of agricultural problems, very often in collaboration with other organizations and the universities.

19. The universities specializing in agriculture are making increasing use of radioisotopes and radiation. With new facilities and equipment, good progress is being made in not only research applications, but also in training.

MEDICAL

20. The recent decision to establish a new Department of Nuclear Medicine at the Otago Medical School and the Dunedin Hospital will greatly assist a large number of hospital departments and services. A number of the major hospitals are establishing new radioisotope laboratories as a separate unit. Previously the work was undertaken within the various radiotherapy departments. The increase in usage of radioisotopes and radiation treatment is making heavy demands on trained staff throughout the country.

21. The radioisotopes used in New Zealand in 1969 are listed in the National Radiation Laboratory's Annual Report and this shows that the main users are "Hospitals and medical research laboratories". During the period mentioned, of the 3085 orders for radioisotopes, 2759 came from hospitals and medical laboratories. In 1958 the orders for hospitals, etc., totalled only 199.

UNIVERSITIES

22. Courses in nuclear physics, radiochemistry and nuclear engineering are available. At the University of Canterbury, by utilizing a sub-critical assembly and computer facilities, post-graduate studies are undertaken on simulated instrumentation and control operations of nuclear power stations. Biochemistry and other departments are making increasing use of various nuclear techniques.

23. Co-operation and joint projects are carried out in conjunction with the staff of the Institute of Nuclear Sciences of the D.S.I.R. The sharing of major facilities continues to grow in a most satisfactory manner.

24. The nuclear physics research at Victoria University centres around nuclear structure studies, in which a 500-keV Van de Graaff accelerator within the department and the 3-MeV accelerator at the Institute of Nuclear Sciences are used.

25. The Nuclear Physics Department of the University of Auckland has three particle accelerators (described in previous reports) and has completed a most successful research project, a polarized ion source for protons or deuterons. Studies in theoretical physics continue.

INSTITUTE OF NUCLEAR SCIENCES OF THE D.S.I.R.

26. At present the Institute's major nuclear facility is a 3-MeV Van de Graaff proton-electron accelerator. Valuable work is carried out at the Institute in the field of isotope geochemistry - stable isotope variations in the elements oxygen (the " ^{18}O to ^{16}O " ratio) and sulphur (the " ^{34}S to ^{32}S " ratio). The long-standing and advanced work of the Institute in the field of radioactive dating, using carbon-14 variations, tritium and potassium-argon methods, has aroused interest both in New Zealand and abroad, and many samples from overseas have been sent to New Zealand for analysis. The Institute's 500-curie cobalt-60 source has been of considerable value to primary and secondary industry. Work at the Institute is expanding in the field of nuclear physics and also radiation chemistry. No developments have taken place regarding the research reactor recommended for the Institute.

NEW ZEALAND ATOMIC ENERGY COMMITTEE

27. This Committee, directly responsible to the Minister of Science, is charged with the responsibility amongst other things of advising the Minister on any aspect of research, development or application of nuclear science in New Zealand.

28. The Committee maintains contact with many overseas atomic energy authorities and international agencies. Through its secretariat and specialist sub-committees, the Committee assists and encourages scientific exchanges, fellowships and training and acts as the national liaison body for most nuclear matters in both technical and administrative spheres.

PHILIPPINES

GENERAL

1. There has been considerable progress in the execution of atomic energy programmes and projects in the Philippines, particularly at the Philippine Atomic Energy Commission. In addition, work has been done by other research agencies co-operating with the Commission, under research contracts with the International Atomic Energy Agency. Some of the activities which might be of interest to the Agency and the Member States are briefly summarized in the following report.

CROP IMPROVEMENT

2. Radiation mutation studies on IR-8, a high-yielding rice variety developed by the International Rice Research Institute, have produced a very promising mutant with shorter stems and improved grain shape (long and with a less chalky belly), which has been found to be more resistant to rice-blast or bacterial blight disease. It matures earlier and may out-yield the original IR-8.

3. Mutation studies aimed at the development of the Lincoln Soybean into a high-yielding and high-protein variety are in progress. Present mutant lines mature two weeks earlier than other soybean varieties.

FOOD AND ANIMAL PEST CONTROL

4. Studies on the control of fruit flies (Dacus dorsalis Hendell) by the sterile male technique are being pursued with vigour since this pest does considerable damage to fruit at almost any stage of development. It has been a constant scourge to local fruit growers because conventional methods of controlling this pest have not been very effective.

5. Similar studies are being conducted on the effects of radiation on the destructive oriental migratory locust (Locusta migratoria manilensis Meyen) and the rice stem borer (Chilo suppressalis Walker). The studies are aimed at finding out how to control effectively the reproductive capacities of their respective progenies.

6. The possible eradication of insect pests that destroy stored products like rice, corn, flour, copra and others is being investigated. Exploratory tests on the effects of gamma radiation have been made on the different life stages of these insects.

7. Another important research activity is being carried out to determine whether ionizing radiation can produce lethal genes in irradiated parent field rats that may be transmitted to their progenies. A study of the haematological response of the irradiated rats to ionizing radiation is also being made in order to determine their capability of mating with rats in the field.

8. Further studies are being conducted on the metabolism of cobalt-60 in snails (Lymnaea rubiginosa) which transmit liver fluke disease in cattle and carabaos. A number of field trials has been made on the dispersion habits of this host.

SCHISTOSOMIASIS CONTROL

9. Studies on the induction of acquired resistance by monkeys to schistosomiasis with the use of irradiated cercariae are in progress. Their aim is to determine whether the production of a vaccine that could be used to immunize people from this disease is feasible.

PROMOTION OF THE INDUSTRIAL APPLICATIONS OF RADIOISOTOPES

10. The use of radioisotopes and radiation sources for industrial purposes has continued to gain the acceptance of various agencies and private concerns in the Philippines. A number of cement plants, cigarette factories, glass manufacturers, petroleum refineries, mining and lumber companies have sought and availed themselves of the expert services of the Philippine Atomic Energy Commission's scientists and technologists in the course of their operations.

11. Feasibility studies and experimental work involving the use of radioisotopes were conducted for special applications, such as the determination of the flow-rate of process materials in pipelines at the request of a mining company, the marking of interfaces to measure the intermixing of oil products for another company, and the quantitative determination of mercury in the chlorine-caustic cells of a vinyl plant.

12. Technical assistance was extended to an electric company for the gamma radiographic inspection of the pistons of its diesel engines and in the training of its personnel for this type of work.

13. Radiation-induced graft polymerization techniques are being used experimentally on building construction materials like wall-boards from sugar-cane bagasse, sawdust and rice straw to make these resistant to water, insects and fungi.

14. Wood plastic combination methods are being applied to selected species of wood and bamboo to improve their physical properties.

LOCAL TRAINING OF SCIENTISTS

15. The Commission's Nuclear Training Institute has continued to provide the major facilities for the local training of scientists and technologists in atomic energy. Whenever possible the Institute tries to integrate its courses with university studies in the nuclear sciences so that the students can apply for academic credits in their respective specializations. A total of 92 scientists, technologists and teachers graduated after completing the following training courses: the radioisotope techniques training course, the radiological health and safety course, the course in the industrial uses of radioisotopes, the course in neutron activation analysis, the seminar in nuclear technology for university faculties and the seminar in nuclear science for high school science teachers.

TECHNICAL ASSISTANCE

16. The Agency has been the chief source of many forms of technical assistance for various atomic energy projects in the Philippines. During the past year, it made available the services of four experts, one each in radioisotope production, neutron activation analysis, food preservation and radiation genetics. In addition, it provided equipment, which included thermoluminescent dosimetry equipment, a plant growth chamber, and a 20 000-curie cobalt-60 source, to a total value of \$31 000.

17. A low-temperature (cryogenics) laboratory has been started with the installation and initial operation of a Philips liquid nitrogen plant acquired through Agency assistance.

18. Research contracts for new and some continuing projects were received from the Agency. One new award was for the irradiation of some local sea food products, with Agency assistance in the amount of \$4500. Studies on the nutrition of the coconut palm, using phosphorus-32 as tracer, and the use of neutrons in seed irradiation are in progress, with Agency contributions of \$4000 and \$3000 respectively. One project on the study of the sorptive characteristics of local

tuffs for waste disposal and treatment, the contract for which was terminated in November 1969, is now being continued without financial assistance from the Agency. Thirteen new fellowships were requested and approved for 1970.

19. An application for the renewal of a research contract on the use of induced mutations in rice improvement has been submitted to the Agency. As already mentioned, our team of research workers has made significant strides in the improvement of the internationally known IR-3 and other rice varieties. While work is continuing on this project, we are anxiously awaiting the desired financial assistance that is being requested from the Agency.

STUDIES IN PHYSICS

20. The following studies in physics are in progress:

- (a) A study of the static properties of solids by determination of the angular correlation functions of selected nuclei incorporated in solids;
- (b) A study of the interaction of the nucleus with electric and magnetic fields in molecules and atoms by atomic and molecular beam spectroscopy;
- (c) Studies relating to pure nuclear quadrupole resonance spectroscopy;
- (d) Studies relating to Mössbauer spectrometry; and
- (e) Studies relating to neutron spectrometry.

PARTICIPATION IN THE INTERNATIONAL NUCLEAR INFORMATION SYSTEM (INIS)

21. Early this year the Commission recommended participation by the Philippines in INIS. It is felt that the Philippines would greatly benefit from its services as well as contributing something to the world's nuclear information bank. A liaison officer for the Philippines has been appointed and some work has been started on the preparation of input for INIS.

AGENCY MEETINGS

22. The Philippines was host to the Joint FAO/IAEA Meeting on Isotopically-Labelled Fertilizers in Rice Production held in Manila from 16 to 20 February 1970. Fourteen participants from eight countries and two international organizations together with a number of local observers attended this meeting.