

PEACEFUL USES OF ATOMIC ENERGY

CHEMICAL, METALLURGICAL AND GENERAL TECHNOLOGICAL SESSIONS AT GENEVA

By DR. R. SPENCE, C.B.

THE economic aspects and engineering design of nuclear power reactors naturally provided the main theme for the recent Conference on the Peaceful Uses of Atomic Energy held in Geneva; the supporting sciences and technologies were, however, adequately represented in parallel sessions which commenced on August 11 and finished on August 20. The *A* Sessions were mainly devoted to physics and reactor engineering; raw materials, chemistry, chemical technology, metallurgy and waste disposal problems were discussed in the *B* Sessions, while the *C* Sessions were concerned with medical and biological problems and with applications of radioisotopes.

Until quite recently, it would not have been possible to hold useful international discussions on some of these topics, but the situation has changed so rapidly during the past few months that the United States, Great Britain and Canada have been able to release a very substantial amount of technical information. The complete success of the Conference was assured when it also became known that there would be important contributions from the U.S.S.R. Undoubtedly, the greatest mass of information, in practically all fields, was supplied by the United States, and many very comprehensive survey papers were included. There were about as many Russian contributions as British, but they were not so evenly spread; for example, there were no Russian papers on chemical processing or on waste disposal. Contributions from other nations were sufficiently numerous and sufficiently important to give the Conference a truly international flavour.

One of the most valuable papers in the *B* Sessions, and perhaps one of the most important in the whole Conference, was that given by Mr. Jesse Johnson, head of the Raw Materials Division of the U.S. Atomic Energy Commission. He estimated that at least one million tons of uranium can be extracted at a reasonable price and that much more is obtainable. This means that there will be no shortage of uranium even for substantial natural uranium power schemes such as that recently announced by Great Britain. In the Russian exhibit there was a particularly fine display of uranium minerals, and the paper by H. Sankhoff on location of ore bodies by radiochemical analysis of ground waters was specially interesting, as no other country appears to have used this method systematically.

There were very detailed American papers on the production of heavy water, on the production of the atomic energy metals and on graphite, together with important contributions from Britain, Canada, France and the U.S.S.R. These papers, and the discussions which followed them, will allow those countries which hope to initiate an atomic energy programme of their own to make an appreciation of the feasibility of producing some of the necessary materials themselves. It was made clear in some of the economic discussions in the plenary sessions that the factors which the so-called under-developed countries would take into consideration in making their appreciations might be quite different from those

ruling in the case of the technically advanced countries. Countries with local supplies of one or other of the necessary raw materials may not be deterred by purely economic considerations, therefore, from setting up their own factories or refineries.

The situation as regards the chemical processing of irradiated reactor fuel seems to be rather different. In spite of the fact that the chemical processing plant is an essential component in the industrial atomic power complex, and that the information released at the Conference was exceptionally complete, the discussion in the sessions dealing with this subject was restricted to the specialists, mainly those coming from the United States and Britain. This may have been due to the fact that the processing sessions were held on the penultimate day of the Conference, by which time delegates were visibly tiring; but it was more probably due to a general acceptance of the likelihood that such plants will have to be designed, built and perhaps operated by organizations within the technically advanced countries.

The sessions on waste disposal were most instructive, although here again the bulk of the information was provided by the United States and Britain. It was particularly interesting to hear an account of the elaborate storage system for highly active liquors which has been installed at the great Hanford works in the United States. Several speakers emphasized that the scale and cost of the highly active storage and disposal facilities are very greatly dependent on the nature of the reactor and chemical plant with which these facilities are associated. On the other hand, it was admitted that even some of the more elaborate systems would add only a small percentage to the cost of power generated. The real problem is the danger and embarrassment which would arise if there should be any accidental spread of these highly active liquids. There seemed to be general agreement on the policy to be adopted in a nuclear power scheme, namely, concentration, separation of caesium-137 and strontium-90 and storage of the less dangerous residue for ten to fifteen years with ultimate burial or discharge to sea, perhaps after extracting some of the more useful isotopes.

In contrast to the chemical processing and waste disposal sessions, there were notable Russian contributions in those sessions dealing with laboratory facilities for handling highly radioactive materials and with the effects of radiation on materials. While nothing was disclosed which was outstandingly new, it was evident that the Russian laboratories are well equipped in this respect and that much useful work is going on there. Similarly, in the fields of inorganic chemistry and radiochemistry and in analytical chemistry, it was quite evident that Russian scientists are well advanced. They reported, for example, interesting work on elements such as ruthenium, americium and technetium, and a new application of the isotope dilution technique to the emission spectroscopic method of isotopic analysis. Very fine review papers were presented in most of these sessions by American authors and there were also

certain outstanding contributions from the United Kingdom, notably the paper on the chemistry of ruthenium, which was far in advance of any other work on this element reported at the Conference. The Barker square-wave polarograph, which was shown in the United Kingdom exhibit at the Palais des Nations, also attracted considerable attention from analytical chemists as a new and original instrument of great potentiality.

The two exhibitions, one in the Palais des Nations and the other in the Salle des Expositions in Geneva, were both extremely good. The United Kingdom sections in particular received universal praise, which the hard-working organizers thoroughly deserved.

For chemists and metallurgists as well as for engineers and physicists, the Conference was a tremendous success. To discuss matters which have been kept secret for so long, in the free atmosphere of an international conference, was an exhilarating experience, and to establish personal connexions with other scientists who have been working in the same field was extraordinarily beneficial. Possibly after more sober appraisal, it may be found that the value of the Conference to the United States, Canada and Great Britain lies mainly in such intangible benefits as those just mentioned; but there can be no doubt that for the world at large the gain was a great one.

GOUGH ISLAND SCIENTIFIC SURVEY

By J. B. HEANEY

Organizer

AN eight-man expedition, most of whose members are graduates of Oxford or Cambridge, left the United Kingdom at the end of August to carry out a six-month scientific exploration of Gough Island. The island is one of the few high peaks of the Mid-Atlantic Ridge that pierce the ocean surface, and lies some 260 miles south-south-east of the three islands of the Tristan da Cunha group; it is a remote outpost of the Commonwealth, 1,500 miles from the Cape of Good Hope, and in the path of the 'Roaring Forties', which, by all accounts, give it an unfriendly climate with frequent ferocious storms and often cold, damp and foggy weather.

The conception and organization of the Gough Island Scientific Survey were mine, but, due to medical advice, I cannot take part in the field-work, and the leadership of the party has been handed over to Mr. Robert Chambers. The expedition is actively supported by the Royal Geographical Society, the Scott Polar Research Institute, the Mount Everest Foundation, and many other bodies and scientific institutions in Great Britain.

Uninhabited by man, Gough Island is a precipitous mass of volcanic rock rising to nearly 3,000 ft.; it measures about eight miles by four, and from its western storm-beaten beaches cliffs tower to 1,000 ft. Mountaineering techniques will be employed to enable the party to travel freely over the area.

The island has been described as a 'naturalist's paradise'; and is the only remaining sub-antarctic island which has not been thoroughly investigated. It has a luscious vegetation of small stunted trees, tree-ferns, tussock grass and mosses, and a rich bird life. It is the home of a unique species of flightless rail which has lost the use of its wings through processes of natural selection; some of the insects will probably show the same degeneration. Large numbers of albatrosses and rockhopper penguins nest on Gough Island, and every year an increasing number of fur seals and elephant seals haul out to breed on the beaches. These animals were exterminated from the island by the depredations of the sealers during the past century, and since their exploitation became unprofitable the island has been visited on very few occasions. In 1904 the expedition ship *Scotia* called, homeward bound from the Antarctic, and small collections were made on the island on one day, and again in 1922 members of Shackleton's last expedition

from the *Quest* spent four days ashore. Present knowledge of the island's geology and natural history is chiefly based on collections made on these two occasions, and also on those made by a Norwegian who spent a few hours ashore in 1934. That a detailed scientific investigation of Gough Island is eminently worth while is indicated in an article by Prof. R. N. Rudmose Brown, of the *Scotia's* party, when he wrote, "No doubt looked at from an impartial standpoint, Gough Island is but a relatively insignificant rock in mid-ocean, but its very isolation makes it of great interest. It may throw light on some former continuity of land in the Southern Hemisphere, and it cannot fail to elucidate various problems of biological distribution when its fauna and flora have been thoroughly investigated. It is for these reasons that its further exploration is so much to be desired".

The members of the expedition, with the qualifications and ages, are listed below: R. J. H. Chambers (leader, surveyor), 23; J. P. Hall (camera-man), 32; M. W. Holdgate (zoologist), 24; R. W. Le Maitre (geologist), 21; P. J. Mullock (radio operator), 22; J. J. van der Merwe (meteorologist), 29; M. K. Swales (zoologist), 24; N. M. Wace (botanist), 26. Van der Merwe is a South African Government meteorologist.

Gough Island lies in the path of weather approaching South Africa, and one of the tasks of the expedition will be to transmit reports five times a day to the Weather Bureau, Pretoria. By comparing simultaneous readings from Gough and from the existing station on Tristan, it should be possible to orient fronts, and to fix more correctly the centres of passing depressions so that their time of arrival in the Union may be forecast more accurately. Dr. T. E. Schumann, director of the South African Weather Bureau, is sponsoring the programme for synoptic reports, and welcomes this opportunity of testing the value of Gough Island as a permanent meteorological station. Some research will also be carried out on the air currents and local clouds formed around the island, which behaves as a small land mass in the path of a steady prevailing wind.

The main emphasis of the field-work will be on various biological programmes. First and foremost, these will consist of making thorough collections on the island; it is to be expected that there will be