chemical investigations of wheat quality. The Bread Research Institute has agreed to house this unit in its new laboratories and the director of the Institute will act as officer-in-charge of the unit.

The work of the Institute has had a very marked effect in improving the standards of the baking industry, and is recognized by bakers throughout Australia, with whom it keeps in close touch. It has provided a testing service for flour and other raw materials used in the industry, and by means of demonstrations by travelling bakers and a series of newsletters and publications it has brought knowledge and practical advice to bakeries throughout the country. It has also built up an important programme of fundamental research in various aspects of wheat and flour quality, the properties of doughs and other subjects. This work has been done in close association with the Organization, the State Departments of Agriculture and some of the universities.

The Institute's influence now extends strongly to the flour milling industry, where its work has been largely responsible for the establishment of standards of flour quality. This has been important to the bread industry, which is thus enabled to insist on definite quality specifications for the flour it buys and has been particularly important for building up the export trade in wheat and flour. The Department of Trade and the Australian Wheat Board have called extensively on the services of the Institute in this connexion, and officers of the Institute have visited Japan and other countries in the East and Middle East to advise on the use of Australian wheats.

U.K. ATOMIC ENERGY RESEARCH ESTABLISHMENT: WANTAGE RESEARCH LABORATORY

By B. S. SMITH

Head of the Isotope Research Division

AFTER about ten years successful expansion of the production, sales and use of radio isotopes, United Kingdom Atomic Energy Authority decided to reorganize its isotope research and production so as to encourage the further expansion of the use of isotopes which may be expected in the next few years. The irradiation of the raw materials will continue to be carried out in the Authority's nuclear reactors at Harwell, Calder Hall and Chapelcross. The preparation of isotopes, the synthesis of labelled compounds, and the marketing are being concentrated at the Radiochemical Centre at Amersham. Research on the applications of radio isotopes and on the use of radiation has been concentrated in the Isotope Research Division of the Atomic Energy Research Establishment. The new laboratories of this Division are at Wantage, and were formally opened by Lord Hailsham on May 16. In these laboratories the Authority has created a focal point where extensive facilities for work with isotopes and radiation sources are being used by about two hundred scientists, half of which are graduates in a wide variety of disciplines.

As the nuclear power programme develops, almost unlimited quantities of radiocæsium will become available, and one of the tasks of the Division is to examine the uses of massive radiation sources. The high cost of a plant to extract and encase cæsium from fission products makes it more economical to use cobalt as an irradiation source until such time as the demand justifies the construction of a large chemical separation plant. Fortunately, the nuclear power programme can provide as a by-product considerable quantities of radiocobalt, and it is this cobalt which will be the basis of the radiation programme for some years.

There are twenty-three large versatile irradiation cells in use. They are concrete shielded rooms in which the experimental apparatus can be set up under radiation-free conditions, and then irradiated by a pre-determined configuration of sources. The source strengths at present in use range from 100 to 10,000 curies, and several of the cells are temperature controlled.

In the radiation chemistry field, investigations have been concentrated on such chain processes as polymerization, oxidation and halogenation. The effects of radiation on catalysts are also being studied. In the food and medical applications section, the use of radiation for sterilization of equipment is giving encouraging results, particularly in expanding the use of plastic materials which are unsuitable for heat sterilization. A study is being made on the use of radiation for the control of *Salmonella* in frozen eggs, desiccated coconut, and imported cattle feed with a high protein content. The plant genetics section has been studying the external factors which influence the radio-sensitivity of plants and the conditions under which radiation can be used to break down the interspecific incompatibility.

The Laboratories have a small animal house for testing food and pharmaceuticals for possible toxicity, glass houses and trial beds for the plant genetics work, and constant temperature rooms for insect culture.

To gain experience at the pilot stage of projects, and to allow manufacturers to carry out extensive trials, a package irradiation plant has been built in conjunction with the Owen Organization and is at present undergoing proving trials. The plant permits the automatic handling of standard packages ($14 \times 12 \times 9$ in.) through an irradiation field providing a dose of 10,000 rads to 5 megarads, according to the rate of traverse. The capacity of the plant is about 100 cu. ft. a day at a sterilizing dose of 2·5 megarads, and larger quantities at lower total doses. The plant is initially loaded with 150,000 curies of cobalt-60 and the cost of giving 1 cu. ft. of material a dose of 2·5 megarads is about 15*s*. This cost will be considerably reduced in plants designed for a special purpose. It is planned to rent four-fifths of the capacity of this plant to industrial concerns, and although it is not yet in operation its capacity has already been oversubscribed.

The Laboratory also operates an irradiation pond at Harwell. This uses the high gamma flux available from the spent fuel elements from the *Dido* and *Pluto* research reactors. It consists essentially of a water pond 20 ft. deep with facilities for mounting the freshly discharged fuel elements in a lattice containing a number of irradiation positions. The material to be irradiated is placed in watertight cylinders ($3\frac{5}{8}$ or $7\frac{1}{4}$ in. diam. and 30 or 48 in. long) which are then lowered through the water shield to the irradiation position. The pond usually contains more than a megacurie of fuel element activity and will give up to 4 megarads/hr. in the small irradiation cans. The present charges for irradiation in this unit work out at about 10*s*. per megarad to a cubic foot of material.

In addition to the cobalt and fuel element sources, there is a 4-MeV. linear accelerator with a 2-kW. electron beam output. It is used principally for treating small samples to high dose-levels of the order of 10^8 rads and also to study dose-rate effects. It gives dose-rates a hundred times higher than those available from the gamma cells.

The Division has medium-level and tracer-level chemical laboratories. The fields covered are wide and include the incorporation of isotopes in colloids for medical studies, improved methods of synthesis of labelled compounds, the use of autoradiography as an analytical tool in metallurgy, and the operation of an activation analysis service for other laboratories.

In the physics laboratory a section works in close collaboration with the National Physical Laboratory and other national laboratories on the absolute measurement of radioactivity. It has established standards of radioactivity and issues standards for many isotopes not yet covered by the standards service of the Radiochemical Centre. The work on instruments and radiation detection is largely directed towards widening the fields of application of gauges using radioactive sources and increasing the sensitivity and discriminating powers of detectors so that tracer uses of isotopes can be extended without increasing the quantity of isotope used.

An essential feature of the work of the Research Laboratory is to discover those industrial processes and fields of industrial and academic research where advantages can be gained by the introduction of instruments or techniques using radioactive materials. An experimental and advisory service is operated which will visit firms and discuss general and particular problems, and on a payment basis will make special investigations either on the firm's premises or back in the laboratories. To further this objective, exchange visits are made with the research associations of many trades, and the Department of Scientific and Industrial Research has attached a small group which uses the facilities of the laboratories and acts as a further contact with research and industry.

For a fixed capitation fee, firms can attach a scientist to the laboratory to work on a problem of either general or commercial interest. In this way a satisfactory blending of the skills of the firm in its own field with the facilities and experience of the Laboratory is achieved.

No outline of the facilities of the Laboratory would be complete without mention of the Isotope School. It was first set up at Harwell in 1951 to give basic training in the uses of radioisotopes in research, industry, and medicine. It is open to students from all countries, and provides a basic four-weeks' course several times a year, together with a number of courses on specialized subjects such as medical applications, radiological protection and autoradiography.

PROTECTION AGAINST TIDAL FLOODING IN LONDON

MEMORIES of the effects on the east coast of Britain of the disastrous storm surge of January 31–February 1, 1953, are beginning to dim. A Government report[1], which has recently been published, is therefore a timely reminder that in the vitally important London area there is no justification for complacency concerning the present degree of protection against tidal flooding.

It is true that in 1953 the low-lying areas of London escaped flooding, but the water lapped the top of the defences at many points so that the margin of safety must have been very small. Thus the question might well be asked as to how it is that seven years afterwards the defences of London are still virtually the same, whereas at almost all other vulnerable points on the east coast of Britain they have been greatly strengthened. As will be seen, the explanation lies in the complexity of the problem and the high capital cost of a solution.

In 1953 the maximum level of the surge-cum-tide at London Bridge was 6 ft. above predicted high water. When considering the possibility of a future even higher maximum level, there are four significant features of the 1953 event which should be borne in mind: (*a*) the river discharge was low—only 2,600 cu. ft./sec.; (*b*) the normal tide on which the surge was superimposed was a spring tide, but not a particularly high one; (*c*) the peak of the surge did not coincide with the time of predicted high water, but preceded it by about 2 hr.; (*d*) considerable breaching and overspill into low-lying areas occurred farther down the estuary.

Any of these features could have been more adverse, in addition to which the magnitude of the surge itself might have been slightly greater. In order to investigate these possibilities, tests were carried out on a hydraulic model[2] of the Thames estuary. It was deduced that a major river flood of 20,000 cu. ft./sec. would have raised the 1953 level by 9 in.; also that an increase of 1·5 ft. in the surge height at Southend (or a correspondingly less favourable phasing with tide) would have added about 1·7 ft. at London Bridge, while a 3 ft. increase would have added about 3 ft. at the same point. The relief due to storage in low-lying areas was shown to be quite small—not more than 3 in. Owing to raising of the banks this should be discounted in the future.

Thus it appears that a surge 1·5 ft. higher, coinciding with a freshwater flood, would raise water-levels by about 2·7 ft. above those of 1953. If the extreme, though exceedingly remote, case be considered of the highest possible surge coinciding with a peak spring tide and a freshwater flood, then the resultant water-levels might be expected to be about 6 ft. above 1953.