

temperatures. In extensive tests at Umberumberka (Broken Hill) and at Lake Corella reductions of as much as 50 per cent of the normal evaporation have been obtained in still conditions by dusting with solid hexadecanol, but when the wind velocity exceeds 5 m.p.h. the saving is very much less. The first model of the 'Evaporotron', an instrument designed to yield direct readings of evaporation from natural sources on the eddy-flux principle, has been completed. Fundamental study of the physics of wool has

established the existence of a transition temperature above which irreversible change occurs if the wool fibre is strained, and also that fibres of animal tendon have a transition temperature only slightly above normal blood temperature. Investigations of the retarding of non-enzymic browning of stored food by addition of sulphur dioxide or bisulphite indicate that the bisulphites may act through oxidation of the carbonyl compounds found in the aldose-amine reactions preceding browning.

STRONTIUM-90 IN HUMAN DIET IN THE UNITED KINGDOM, 1959

A REPORT by the Agricultural Research Council contains the results for the second year of the survey of strontium-90 in human diet in the United Kingdom which was initiated by its Radiobiological Laboratory in 1958*. Two types of investigation are described: a country-wide survey, which enables the mean ratio of strontium-90 to calcium in the average diet of the population to be assessed, and local studies in areas where the quantities of strontium-90 in the diet are likely to exceed the average.

The general organization of the country-wide survey was similar to that in 1958, though some additional foods were examined. The major effort was devoted to milk; bulk samples were prepared for analysis from milk collected twice each month from some 200 depots which handled more than 40 per cent of Britain's total production. Potatoes, leaf vegetables, flour, cheese, eggs, proprietary cereal-based infant foods and tea were also examined. It has already been reported that the quantity of strontium-90 in milk rose appreciably in the early part of 1959 with the result that the mean value for the twelve months ending in the middle of the year was 40 per cent greater than it had been six months earlier. Afterwards, however, the level of strontium-90 in milk decreased and, in the latter part of the year, it was similar to those observed in 1958; thus, the mean value for the preceding twelve months changed little between June and December. The country-wide mean values at the end of June and December 1959 were 11.7 and 12.2 $\mu\text{c./l.}$ (9.6 and 9.8 $\mu\text{c./gm.}$ calcium), respectively.

It is estimated that the mean ratio of strontium-90 to calcium in the average diet of the whole population in the United Kingdom during 1959 was 9.0 $\mu\text{c./gm.}$ and that it did not exceed 15 $\mu\text{c./gm.}$ in the diet of any large section of the population. Because of the relatively high levels of contamination early in the year, these values are about 50 per cent higher than those estimated for 1958. The estimated level in the diet of the population as a whole, however, represents less than one-twentieth of the maximum permissible level recommended by the Medical Research Council.

During the year, investigations were intensified to identify localized areas where the combination of high rainfall and agricultural factors could lead to abnormally high levels of strontium-90 in human food. Thirteen individual farms or groups of small adjacent farms were examined in wet upland areas in England, Wales, Scotland and Northern Ire-

land. All these areas are small, and only a fraction of the food consumed in them is produced locally. The results of these studies, however, enable conclusions to be reached as to the hypothetical maximum levels of strontium-90 which could occur in the diet of any individual. If it is assumed that an individual could consume the most highly contaminated foods of different types which have been found in these investigations (and these were, in fact, produced in widely separated parts of the country), the ratio of strontium-90 to calcium in the total diet would be 80 $\mu\text{c./gm.}$ This value, which is one-tenth of the maximum permissible level recommended by the Medical Research Council for individuals, is in fact considerably in excess of the likely levels in the diet of any one person. Moreover, it is less than one-third of the maximum permissible level for the whole population.

Milk continues to be the component of diet which contributes the largest quantities of strontium-90. The ratio of strontium-90 to calcium in milk is, however, similar to, or less than, that in many other foods. Since the concentration of strontium-90 in newly formed human bone depends on the ratio of strontium-90 to calcium, rather than on the absolute quantity of strontium-90 in the total diet, milk should not be regarded as giving rise to any special hazard.

Variations in the composition of diet usually have only small effects on the mean ratio of strontium-90 to calcium in the total daily intake. The only substitution in a normal diet which is likely to have a significant effect is that of wholemeal bread for white bread. The calculations in this report for the average mixed diet are for that containing white bread. The substitution of wholemeal bread which contains a higher quantity of strontium-90, and does not generally contain added calcium of mineral origin, would not, however, increase the ratio of strontium-90 to calcium in the average mixed diet by more than 6 $\mu\text{c./gm.}$ This increase is less than one-fortieth of the maximum permissible level for the general population.

Because climatic factors can exert considerable effects on the quantities of strontium-90 and of calcium which are absorbed by plants, and hence on the levels in human diet, it is not possible to make quantitative predictions as to the situation in the immediate future. There is, however, considerable evidence that strontium-90 which has hitherto been released into the atmosphere has already exerted its major effect; decreasing levels in human diet may therefore be expected in the future.

* Agricultural Research Council. Radiobiology Laboratory. Report No. 3.: Strontium-90 in Human Diet in the United Kingdom, 1959. Pp. x+58. (London: H.M. Stationery Office, 1960.) 3s. 6d.