RADIOACTIVITY IN FOOD

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Radioactive materials present in food can result from the following five sources:
(1) Naturally occuring radioactive minerals.
(2) Cosmogenic Radio nuclides.
(3) Bomb fallout Radioactive materials.
(4) Radioactive materials emitted from coal-fired power plants.
(5) Releases from nuclear industry.

(1) Naturally occuring Radioactive minerals

Uranium and Thorium have been present on earth from its origin. Radioactive decay of these produce radioactive decay products which in turn produce further radioactive products. This produces a series of radioactive products. Radioactive materials from this source are present everywhere. But in some areas, these are present in higher concentrations, and can be absorbed by plants. The author has carried out studies in such high radioactivity areas in Sri Lanka during the last 12 years and two students have received M.Phil and M.Sc. degrees on this work. Based on exploratory work, it was felt that uptake of these by plants must be largely restricted to the soluble radionuclides and it is possible that each plant has some levels of selectivity.

Potassium—40 is a very long lived radionuclide that has been present on earth from its origin. 119 ppm of natural potassium is radioactive K—40 and all sources of natural potassium contain this fraction of radioactive potassium. A man of standard weight has about 3700 Bequerrels of radioactive potassium in his body. A heavier man will have more.

(2) Cosmogenic Radio nuclides

Cosmogenic radionuclides are those formed by the interaction of cosmic rays with the atmosphere. Carbon—14 and tritium—3 are the main radionuclides produced in this manner. Natural carbon containes 0.25 Bequerrels of carbon—14 per gram of carbon. Natural water contains about 0.3 Bequerrels of tritium per litre.

(3) Bomb Fallout Radio nuclides

Atmospheric weapon tests, particularly in the 1960's, injected radioactive nuclides such as Sr-90, Cs-137 and tritium to the upper layers of the atmosphere and these are slowly deposited on the surface of earth. At present there is a layer of these materials all over the earth, the fallout being higher in the Northern latitudes than in our part of the earth. These are usually bound to the soil. However, the extent of such binding depends on the nature and composition of the soil. These materials can be absorbed by plants if they are not sufficiently strongly bound.

(4) Radioactive materials emitted from coal fired power plants

Coal contains Uranium, Thorium and other radioactive decay products. When coal is burnt these are released to the atmosphere and the materials later settle down on plants and water. The plants are later eaten by animals whose flesh is in turn eaten by man. Some radioactivity enters the food chain in this manner.

(5) Release from the nuclear industry

The main concern at present on radioactivity in

food arises from the contamination of food resulting from the radioactive releases from the Chernobyl Nuclear accident in the USSR. Radioactive materials released by the accident were carried by the wind all over Europe. Some of these materials were deposited in these countries depending on the conditions prevailing at that time. For example, where there was light rain, large quantities of these materials got deposited on leaves. Where there were heavy lasting showers, the materials not only got deposited, they also got washed off the leaves of plants.

The radionuclides of main concern in an accident like this are Iodine—131, Caesium—137 and Caesium—134.

Once these radionuclides get deposited, they can enter the food chain either directly or indirectly. The main route into food is through animals like cattle, sheep, goat and also reindeer. Cattle eat grass and usually cover a large area a day accumulating whatever radioactivity has been deposited on it. Materials like Iodine and Caesium find their way into milk and flesh with accumulative effect. Sheep and goat scrub the grass with roots and traces of soil and usually are prone to collect more radioactivity. Reindeer feed on lichens which accumulate radioactivity and therefore reindeer flesh usually contain higher levels of radioactivity.

Absorption of the deposited radioactivity by edible plants and its solution in potable water resources also enter these materials into the food chain.

The problem of I-131 lasts only for a short period because of its short half life. At present the main concern with respect to this accident is on radioactive isotopes of Caesium.

A problem of radioactive contamination of food of this level was never experienced before and therefore when this accident occured, no country had laid down the levels of radioactive contamination that should be permitted in food served to a general population which consists of all categories of people, infants, children, pregnant women, old, sick and weak people. European countries which were the directly affected ones had to lay down emergency levels to cope with the crisis. These levels are valid for a limited period.

When the possibility of contaminated food arriving in Sri Lanka arose, immediate action had to be taken to control the problem. The main criterion to be used here is that as Sri Lanka is not a country affected by the accident, it is not necessary for Sri Lankan people to have any radioactive contamination in their food. This is to be in conformity with the ALARA principles. At this time we had no information about the action taken by other countries or the level of radioactivity in imported foods. As such, a temporary level of 13.5 Bq/Kg was accepted and a Committee consisting of experts in the field was appointed to decide on the suitable level. During the month after imposing the 13.5 Bq/Kg level, more information such as the levels of activities in the foods imported, certificates with incorrect information, levels set by some other countries became available. Within one month a great deal of information was obtained by examining many samples.

Some countries which only export food, particularly milk foods, had accepted the emergency levels laid down in Europe. Some countries officially accepted and implemented the European levels for export but unofficially enforced much lower levels for food meant for internal consumption. The Philippines had accepted a level of 22 Bq/Kg. for milk powder. Singapore had laid down the condition that no contamination whatsoever is allowed. India had laid down a normal level of 30 Bq/Kg applicable under normal circumstances such as now and an emergency level of 300 Bq/Kg. which will be applicable if a nuclear emergency happened in India.

After studying all these, the Committee appointed by the Atomic Energy Authority laid down a level of 20 Bq/Kg. as the maximum permitted quantity of radioactive Caesium isotopes in imported food.

Testing food for radioactive contamination is carried out at the Radioisotope Centre at the

University of Colombo where the staff is very small. The Centre has four scientists, two have academic degrees Ph.D's, M.Phil's and M.Sc's. However, when one considers persons with formally recognized training in Radiation Protection, there are only two i.e. the Director and the Chief Technician, Mr. Ratnayake. There are two scientists with formal training in Radiation Protection at the Atomic Energy Authority. At present all food imported from Europe is tested for radioactivity.