

CONTAMINATION OF FOODSTUFFS BY RADIATION\*

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by

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With regard to the cause of contamination of foodstuffs by radiation from the A and H-bomb tests conducted by the United States and the U.S.S.R. which created a great problem last year, my considerations are generally along the following three points.

First is the contamination of migratory fishes such as tuna, marlin, etc. The result of analysis made in our laboratory revealed that the dreadful strontium 90 content of fish was about 0.3%. Moreover, at the research conference to discuss the data obtained by the members of the SHUNKOTSU MAJU, several of us reported that various parts of the fish were found to be contaminated with a great amount of Zinc 65. Similar findings were also obtained by analytical studies in our laboratory.

Zn<sup>65</sup> is not a so-called fission product. Though this is merely an assumption, the material of the detonating mechanism, for instance, zinc contained in brass, may have been rendered radioactive by neutrons at the time of the detonation. (Dr. Yamasaki's comment)

On the other hand, mollusc and other lower marine animals produce "hemocycopin" (an organic complex salt containing zinc) resulting in white blood instead of having hemoglobin (an organic complex salt containing iron) as in humans. Therefore, they have the property to selectively collect zinc. They are eaten by squids and other small fishes, which in turn are eaten by tuna, marlin, etc. In this way, they presumably were contaminated by radiation. In short, this type of contamination phenomenon is considered to have been passed on by the food the fish eat.

Second is the contamination of vegetables, rice, tea, etc. This is considered to have been due to the contamination by radioactive materials contained in the rain described below.

As to the result of the investigation made on rice-plant, as shown in the chart, no radiation was noted in the rice crop of 1953 (the following study was all made on rice collected in Niigata Prefecture). But, as for the rice harvested in 1954, radiation is definitely noted in chaffs and unhulled rice while no radiation is noted in unpolished rice, polished rice and rice-bran. That is, contamination of rice-plants is external.

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Even in the case of other vegetables, fruits and tea, nearly all are externally contaminated. It is felt that there will be no question about the fact that it was not caused by absorption from the following data:

- (1) That radiation is definitely noted in chaffs as mentioned heretofore.
- (2) That radiation on the upper surface of a Cortinellus mushroom is definitely stronger than that on the under side.
- (3) That only a fairly slight amount of contamination is noted in such high quality tea as "Gyokuro" which is grown under cover.
- (4) That greater radiation is noted on the upper leaves of mulberries which are more exposed to the rain as compared with the lower leaves. (Results of tests at Sericulture Experiment Station).
- (5) That analytical study of radiation of tea revealed matter similar to fission products. (Studies by Professor Shiockawa and our laboratory).

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It is well known that isotopes such as Strontium 90 mixed in fertilizer will be absorbed by plants. However, the contamination discussed here seems, in view of the amount demonstrable from our experiments, to be external.

Some advocate the absorption theory, but their views are incorrect, mostly due to the errors arising from incomplete analysis of potassium and failure to allow for absorption of radiation in the various layers and background radiation in many of the experiments.

At the same time, milk, for instance, also was questioned at one time but the results of the experiments conducted in our laboratory on 30 different kinds of milk from various places revealed no radiation. People had been alarmed since there have been numerous tests with isotopes performed, demonstrating that radiation is found in milk of cows fed severely contaminated grass.

Third is the contamination of rainwater used for drinking purposes. Contamination occurs because the fine particles of radioactive materials suspended in air are absorbed in rain. Radiation in this case, of course, is mostly composed of nuclear fission products. After a certain length of time following the detonation of an A-bomb, for instance, several days later in case of Bikini Atoll, the amount of radiation contained in the rain increases in Japan. In general, radioactive materials from nuclear

fission have a certain composition and the amount of each element is also said to be almost constant. Therefore, radiation in the rain can be expected to consist of a certain composition; the strontium 90 content is several percent. Of course, radioactivity of the radioactive elements decreases in proportion to the number of days elapsed since the detonation, the degree of which greatly differs according to various elements. Hence, the composition of radioactive materials varies.

As for drinking water, rainwater is used in areas where there are no wells and rivers. Since the daily adult consumption is about 2 liters of rainwater and as it is used every day being indispensable to those living on islands or in lighthouses, it is necessary to consider this problem carefully for the sake of health.

As to contamination of water in Japan proper, there have been several experiments made, demonstrating about 100 counts per liter of water. As the cause and process as well as the composition of the contamination were not clearly understood at the initial stage, there was an occasion when the Welfare Ministry issued warnings. However, on obtaining the results of analysis, it seems that the degree of contamination of last year will present no problem.

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Also in the warning given to the Americans by the AEC, their calculation shows that there is no harm even if water containing about one million counts per liter is taken for several weeks. (This count indicates the condition existing for three days after the detonation, and would be several times less a month later). Therefore, only to be exposed to rain containing several ten thousand counts per liter would cause no harm at all.

Next, I should like to comment on the decontamination of radiation. At present, there is no very effective method.

It is extremely effective to thoroughly wash externally contaminated vegetables, fruits, etc., while they are still wet following exposure to the radioactive rain. Once they dry, it is difficult to wash off the radiation, but nothing can be better than washing. In our experiments, 90-100% of the radiation was removed by washing.

In case of drinking water, as shown in the instruction given by the Welfare Ministry, when it is filtered through pebbles, sands and charcoal powder, 90% can be removed. Moreover, if it is filtered through a layer of "anbaraito" IR 120 or Dow X 50, better known as a positive iron exchange resin, it can be eliminated almost completely.

It is impossible to remove absorbed radiation, for instance in the case of contaminated fish. Severe contamination by radiation is noted in the internal organs, such as the kidney, the pylorus, etc., of fish. (The kidneys and livers sometimes are several thousand times more severely contaminated than the flesh.) There is nothing else but to discard them. Care should be taken not to permit the flesh to come in contact with the contaminated organs and it is advisable to wash the flesh, too.

Should any radiation be absorbed in plants, there is no method at present other than to resort to the procedures mentioned above.

In view of the conditions of contamination now being observed in Japan, there is no need to take any particular precaution in the disposal of contaminated materials discarded in our homes and regular procedures will suffice.

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### Contamination of Rice Produced in Niigata Prefecture

The amount of potassium (K) and the counts were studied on the ashes of 10 g of unhulled rice, about 2 g of chaffs, 7 - 8 g of unpolished rice by Geiger Muller Counter.

According to the analytic value of K, the layer and absorption were considered and the counts were taken on an equivalent amount of  $K_2CO_3$ .

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