Radioactivity in Fresh Vegetables

THE Food and Drug Administration's second report on radioactivity in fresh vegetables finds the amount still well within limits recommended by the National Committee on Radiation Protection and Measurements. The report covered 402 samples collected in the latter half of 1958 and 139 collected in 1959. Specimens included cabbage, cauliflower, celery, beans, broccoli, brussels sprouts, collards, beet tops, lettuce, kale, mustard greens, parsley, potatoes, tomatoes, peppers, spinach, turnip greens, and watercress (table 1).

The highest average total beta radioactivity found for any vegetable so far examined was 6,700 micromicrocuries per kilogram of a sample of spinach. The average for all vegetable samples from all sources was 2,520 micromicrocuries per kilogram. The highest single value of total radioactivity was 56,000 micromicrocuries per kilogram obtained on a sample of spinach from Illinois (table 2). (One micromicrocurie is a radioactivity of an average of 2.2 disintegrations per minute.)

Samples of certain U.S. staple foods are sent by the Food and Drug Administration to the Lamont Geological Observatory for strontium 90 analysis. Strontium 90 contents of vege-

Table 1. Total beta radioactivity[1] of fresh vegetable samples, by product, 1958–59

Vegetable	1958		1959	
	Number of samples	Average micromicrocuries per kilogram	Number of samples	Average micromicrocuries per kilogram
Beans	38	590	4	430
Cabbage	77	500	21	240
Cauliflower, broccoli, and brussels sprouts	44	770	17	160
Celery	61	3, 550	23	4, 100
Greens[2]	8	2, 860	18	1, 550
Lettuce	76	2, 680	29	4, 270
Parsley	3	7, 270	1	4, 270
Potatoes	9	1, 050	3	430
Spinach	60	6, 820	21	6, 360
Tomatoes and peppers	26	190	2	0
Totals and averages	402	2, 450	139	2, 860

[1] Less that due to naturally occurring potassium 40.
[2] Includes kale, collards, turnip greens, sugar beet tops, watercress, and mustard greens.

Table 2. Total beta radioactivity[1] of fresh vegetable samples, by State, 1958–59

State	Number of samples	Micromicrocuries per kilogram	
		Average	Range
Alabama	2	530	0– 1, 070
Arizona	9	430	0– 960
Arkansas	3	11, 030	7, 060–13, 460
California	184	4, 960	0–21, 620
Colorado	61	1, 130	0–11, 710
Delaware	1	360	
Florida	21	1, 000	0– 4, 450
Illinois	23	4, 060	0–56, 000
Indiana	9	620	9– 1, 800
Iowa	2	400	50– 750
Kansas	3	330	185– 550
Kentucky	3	1, 430	0– 2, 540
Louisiana	4	220	0– 600
Maine	6	540	50– 1, 250
Maryland	16	1, 650	0– 9, 750
Massachusetts	6	220	41– 360
Michigan	31	370	0– 7, 800
Minnesota	3	0	0– 80
Mississippi	3	1, 120	77– 1, 750
Missouri	10	1, 970	0– 6, 910
Nebraska	5	9	0– 220
New Hampshire	5	150	14– 390
New Jersey	44	1, 160	18–20, 120
New Mexico	9	1, 090	113– 4, 760
New York	28	600	0– 3, 130
North Carolina	9	960	68– 7, 300
Ohio	21	540	0– 2, 250
Oklahoma	1	140	
Oregon	5	550	185– 1, 300
Pennsylvania	2	520	500– 550
Tennessee	7	2, 750	297– 5, 960
Texas	6	170	0– 510
Utah	1	280	
Virginia	26	2, 000	0– 5, 860
Washington	9	700	0– 2, 710
West Virginia	6	120	0– 370
Wisconsin	3	0	0– 45

[1] Less that due to naturally occurring potassium 40.

Table 3. Strontium 90 content of fresh vegetable samples, by State, 1958–59 [1]

Product	State of origin	Total beta radioactivity [2] in micromicrocuries per kilogram	Strontium 90	
			Micromicrocuries per kilogram	Percent of total beta
Cabbage	California	[3]	2.0	
Cabbage	California	910	5.1	0.55
Celery	California	4,180	3.4	.08
Celery	California	4,670	3.4	.07
Lettuce	California	1,840	17	.92
Lettuce	California	3,910	5.4	.14
Lettuce	California	6,490	14	.22
Potatoes	California	[3]	.5	
Cabbage	Ohio	[3]	7.2	
Potatoes	Ohio	[3]	7.3	
Potatoes	Texas	[3]	3.2	
Cabbage	Minnesota	[3]	8.8	
Cabbage	Illinois	[3]	14	
Potatoes	Illinois	[3]	1.8	
Potatoes	Maryland	[3]	5.1	
Cabbage	Kansas	[3]	6.4	
Potatoes	Kansas	[3]	3.3	

[1] Samples examined by the Lamont Geological Observatory, Palisades, N.Y., under a cooperative Food and Drug Administration-Atomic Energy Commission program.
[2] Less that due to naturally occurring potassium 40.
[3] Not available.

tables so far analyzed for this nuclide ranged from 0.5 micromicrocurie per kilogram for potatoes from California to 16.8 for lettuce also grown in California (table 3). Other States covered in the strontium 90 analyses so far completed include Maryland, Kansas, Ohio, Texas, Minnesota, and Illinois.

The National Committee on Radiation Protection and Measurements has recommended 80 micromicrocuries of strontium 90 per liter of liquid or kilogram of solid food as the maximum permissible level, for human consumption, in the diet over an entire lifetime. These levels may be exceeded by varying amounts for varying periods without causing appreciable harm to the individual.

The Food and Drug Administration pointed out that an additional safety factor is provided by the washing, peeling, and trimming which is a normal part of preparation of vegetables either by the housewife or by the commercial processing plant. However, it is not yet known whether some vegetables have a greater affinity for strontium 90 than others.

Total radioactivity and strontium 90 contents of vegetables examined to date are far below the results reported in August 1959 for alfalfa hay. Average total radioactivity for the hay samples was 27,200 micromicrocuries per kilogram, and strontium 90 content ranged as high as 804 micromicrocuries per kilogram.

Alfalfa hay, however, is primarily animal feed rather than human food and the amount of strontium 90 appearing in milk is considerably less than the amount in the cow's diet.

Of the 14 States from which alfalfa hay was sampled, 13 were included in the vegetable samplings. There was considerable overlapping in the time intervals covered by the samplings. The alfalfa samples in every instance showed significantly higher radioactivity on the average than the vegetable samples from the same States. Ensilage samples were found to contain less total radioactivity than alfalfa hay, but in most instances more than the vegetables from the same State.

Reasons for the differences observed between alfalfa hay, ensilage, and vegetables are not as yet known, but presumably may include such variables as moisture content of the crop, length of growing season, climatic factors, and differences in plant metabolism.

In the Food and Drug Administration survey of human food and animal feeds, the beta

particles are detected by an instrument which determines the presence of beta radioactivity from all elements, including those which occur in fallout, as well as those in nature, such as potassium 40.

In order to measure beta radioactivity values that relate to fallout only, allowance must be made for this ubiquitous species of potassium. All total beta radioactivity values reported in the survey have therefore been adjusted by subtracting an amount attributed to potassium 40.

The significance of a total beta radioactivity value is determined by the age of the sample. A sample may be extremely radioactive immediately after exposure to fresh products of a fission reaction, but within a few days it will lose that proportion of radioactivity produced by short-lived nuclides. With time, the proportion of beta radioactivity due to strontium 90 and cesium 137 increases, while total radioactivity declines. Half the radioactivity of strontium 90 and cesium 137 is discharged in about 30 years.

WHO Fellowships for Foreign Study

At the request of the United States Government, the World Health Organization has provided a limited number of short-term fellowships in 1960 for the "improvement and expansion of health services."

The World Health Organization Fellowship Selection Committee, recently established by Surgeon General Leroy E. Burney, is chaired by Assistant Surgeon General David E. Price. Dr. John Parks, Dr. Fred L. Soper, and Miss Julia Thompson, represent the Association of American Medical Colleges, The American Public Health Association, and the American Nurses Association on the committee.

Applications for fellowships in various branches of public health and allied fields will be considered. Applicants must be engaged in full-time public health or educational work. In making selections, the committee will consider the ability of the individual and the importance of the contribution which his foreign study will make on his return.

Fellowships will pay per diem and transportation and, except in very unusual circumstances, will cover from 2 to 6 months. Employers will be expected to endorse applications and to continue salary payments for the duration of fellowships.

The deadline for the receipt of applications has been extended to March 15, 1960. Further information and application forms may be obtained from Dr. Howard M. Kline, Secretary, World Health Organization Fellowship Selection Committee, Public Health Service, Washington 25, D.C.