RADIATION MONITORING OF IMPORTED FOOD TO SAUDI ARABIA AFTER CHERNOBYL ACCIDENT

Samir Abdul-Majid, Waleed Abulfaraj, Mohammed S.Al-Johani, Abdel Megid Mamoon, Abdulrahman F.Abdulfattah and Kollathodi M. Abubakar.

Nuclear Engineering Department
King Abdulaziz University
P.O.Box 9027,Jeddah-21413
SAUDI ARABIA.

INTRODUCTION:

Following Chernobyl reactor accident, King Abdulaziz University (KAU) was assigned the responsibility of monitoring food imports reaching the western ports of Saudi Arabia. This includes the three western seaports of Jeddah, Yanbu and Jizan and the airport of Jeddah. Through the seaport of Jeddah, the largest in Saudi Arabia,essentially all kinds of foodstuffs are entering. Chilled meat, fresh vegetables and other items that can not be stored for long time are coming through Jeddah airport, while Jizan and Yanbu handle mianly barley and animal feed. The monitoring program started in the middle of June. This is the time when pilgrimage season starts and about one million persons come from different parts of the world to the city of Mecca. Food imports drastically increases during this time and large number of live sheep and cows are imported for religious sacrifice.

MONITORING PROCEDURE:

The monitoring process includes the use of 5.08-x 5.08-cm (2-x2-in) NaI(Tℓ)scintillation detector used with counter that gives count rate only. Several samples of few kilograms each are brought from different parts of each shipment for radiation inspection. In this process the detector was either surrounded by the sample material or put on its surface to obtain better counting efficiency. In many cases and whenever possible inspection was done inside the food container where usually better counting is obtained, since more food is present and gamma photons are coming from all directions. An increase of 10 to 20% in the count rate is observed when the sample is containing few hundered Bq/Kg of total radioactivity.

If any increase in the count rate is observed over the background, larger samples were then inspected by a 12.7-x 10.16-cm (5-x4-in) scintillation detector provided with a discriminator and a counter-timer where discrimination was made only against lower level background radiation. This detector was not used to identify radionuclides in the food or for measuring their concentration, but rather to confirm the observation made by the survey meter since the counting time can be extended to any desirable value. Usually 5 minutes is long enough time for such confirmation.

Samples showing increased radioactivity above background are brought to the radiation detection laboratory for radionuclides identification and concentration measurements. The detection systems include a Ge(Li) detector, a pure Ge detector, a 1024 multichannel analyzer, a PC-IBM computer with special electronic board equivalent to 8192 channels along with the associated electronics. The detectors are shielded by lead bricks to reduce as mush as possible the background radiation. Meat samples were cut into small pieces to fill a plastic container where their activity was compared with water (filling similar container) having 1000 Bq/Kg of each of different fission products. Milk powder radioactivity was compared with the activity of another milk powder originally free from radioactivity and then mixed with known amount of fission products radionuclides to give the same concentration as that of water. Radioactivity of other food samples, such as fruits, were compared with water, otherwise different reference sources were made for them. In the measuring system used it was possible to measure concentrations of few Bq/Kg. The Kingdom of Saudi Arabia has initially adopted the acceptable levels of imported food taken by E.E.C. countries namely 600 Bq/Kg and 370 Bq/Kg of total Cs activities for adult and dairy and children food respectively.

RESULTS AND DISCUSSION:

From the middle of June, when the monitoring program was effectively started, untill early September essentially all samples analyzed in the KAU laboratory were meat and milk powder. These food items came from cattle and sheep grazing on contaminated grass. Mainly Cs-137 and Cs-134 were observed, although in the early days other fission products were found as well. During the same period no observation of radioactive contamination of fruits and vegetables was registered. Presumably surface contamination of these items, if any, was removed by washing. In the month of September, radioactivity were found in biscuits, mushrooms and fertilizers in addition to meat and milk powder. About early October, radioactive contamination was detected in nuts, fruits, grain products, macaroni, amber and some indoor plants.

Table 1 shows the type of food analyzed by the gamma spectroscopy system, their total number, the number of those having radiation concentration above the acceptable level and their percentages during the period from the first of July 1986 untill the end of February 1987. During this period large numbers of meat and milk samples were brought for radioactivity analysis. Furthermore a large percentage of them showed levels above acceptable. Wheat and wheat products such as Macaroni, biscuits also showed noticeable amounts of contamination. Clearly the right conclusion on tendency of certain food products to accumulate radioactivity can not be easily concluded from this table because this will depend on the total amount imported of the specific type of foodstuff.

Figure 1 shows the variation of total number of samples analyzed and the number of those showing radiation above the acceptable level with time.From July to September 1986.The samples sent for analysis were decreasing in number. This may be due to the fact that radiation contamination was actually decreasing with time in meat and milk and/or possibly due to recognition by exporting countries of radiation in food and better inspection procedures being applied. After the month of October the number of samples brought for analysis started to increase due to the fact that contamination was found in other varieties of foodstuff in addition to meat and milk. Generally smaller contamination concentration was found.

Figure 2 shows the ratio of Cs-134 to Cs-137 concentration in meat after August 16. Clearly this ratio is decreasing due to the fact that the half-life of Cs-134(2.06y) is much shorter than that of Cs-137 (30y).

Table 1: Types of samples analyzed by gamma spectroscopy method, their total number and the number having radiation level above acceptable.

Sl. No.	Sample Type.	No.of samples received	Percentage out of total	Above acceptable level	
				No.of samples	Percentage
1	Meat	66	29.07	22	33.33
2	Lentils	25	11.01	4	16.00
3	Milk Powder	23	10.13	13	56.52
4	Wheat	17	7.49	1	5.88
5	Macaroni	14	6.16	5	35.71
6	Fig	9	3.96	0	0
7	Biscuit	8	3.52	3	37.5
8	'Mahlab' (*cerasus mahaleb*)	7	3.08	6	85.71
9	Semolina	6	2.64	0	0
10	Plant soil	6	2.64	4	66.67
11	Veg.soup	5	2.20	0	0
12	Dried grass (for animal)	4	1.76	4	100
13	Chocolate	4	1.76	0	0
14	Hazelnuts	4	1.76	2	50
15	Apricot	4	1.76	0	0
16	Apple	3	1.32	0	0
17	Walnut	3	1.32	0	0
18	Chestnuts	3	1.32	0	0
19	Honey	2	0.88	0	0
20	Animal feed	2	0.88	0	0
21	Ambergris	2	0.88	2	100
22	Cumin	2	0.88	0	0
23	Hazelnuts with honey	2	0.88	1	50
24	Fertilizer	2	0.88	2	100
25	Mushroom	1	0.44	1	100
26	Cheese	1	0.44	1	100
27	Almond	1	0.44	0	0
28	Orange	1	0.44	0	0

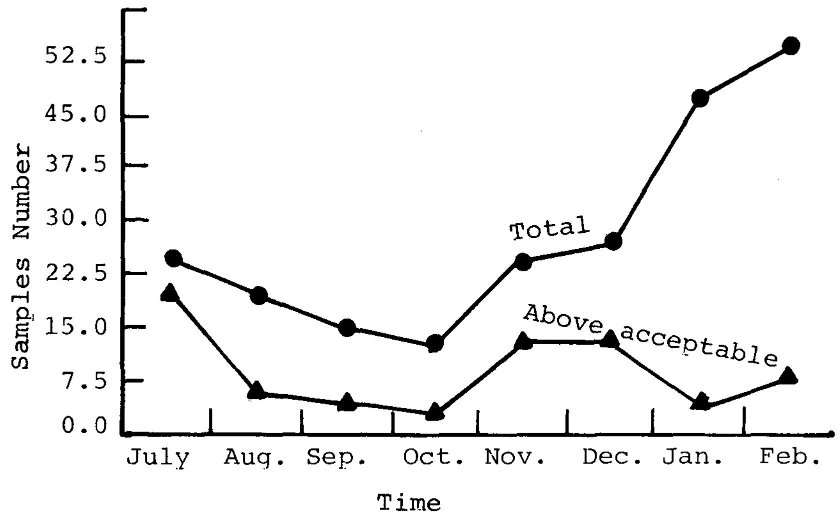

Fig.1: The variation of total number of samples analyzed and the number showing radiation level above acceptable with time starting from July 1986 until February 1987.

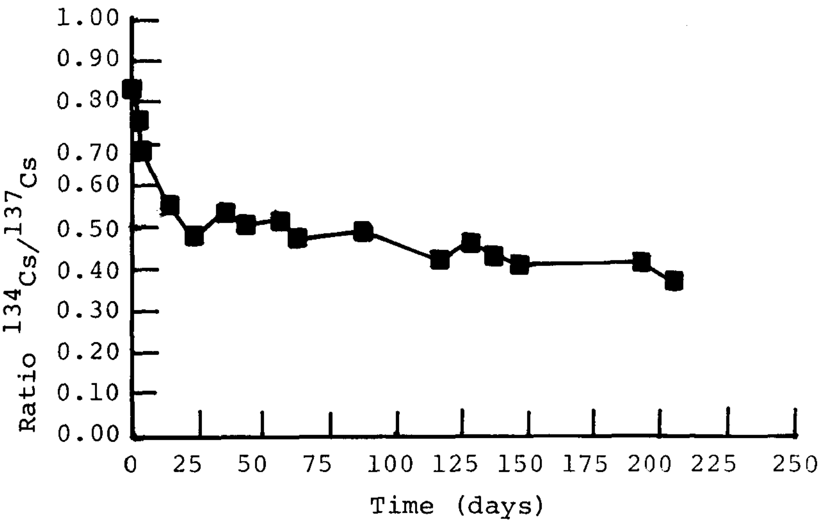

Fig.2: The variation of the ratio of ^{134}Cs to ^{137}Cs concentrations in meat with time starting August 16, 1986.