Subject: Factors influencing the biological availability of radionuclides for animals and man.

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The potential hazard from fallout radionuclides is primarily determined by the I^{131} content and the Sr^{90}/Ca ratio of the total diet. Because of its 8-day physical half-life, I^{131} is a short-term problem of possible concern only within weeks after the contaminating event; Sr^{90}, on the other hand, persists for years in soil and in foods containing minerals derived from the soil.

Fresh milk is by far the most important contributor of environmental I^{131} to the human diet. When pastures are contaminated, I^{131} reaches a maximum concentration in the milk of grazing animals within days; by the same token, when animals are removed from contaminated pastures the I^{131} levels in milk fall rapidly within a matter of days. Knowledge of this behavior can be used as a basis for monitoring requirements and for modifications of feeding practices to reduce the levels of I^{131} in milk if needed.

DISCLAIMER

Many chemicals such as iodide or perchlorate when fed to the cow will reduce the I^{131} levels in milk. However, these chemicals themselves are secreted into milk and might well have an effect on the consumer. At present there is no practical procedure for reducing I^{131} levels in milk by the use of drugs.

The relative biological availability of I^{131} to the human population as related to thyroidal radiation dose can be expressed as:

(% I^{131} uptake per gram of thyroid) (fresh milk consumption)

An analysis of available data on thyroid uptakes, thyroid weights, and fresh milk consumption indicates the following:

(a) the iodine uptake in the fetus younger than about 12 weeks is practically zero

(b) the population group expected to have the highest relative exposure would be 6 months to 2 year old children

(c) the relative exposures to others decrease progressively in both directions of age, decreasing by factors of 10 to 20 for 12-15 week old fetuses and for older persons.

The body burden of Sr^{90} is governed primarily by the Sr^{90}/Ca ratio of the total diet and the comparative retention of these two substances in the body. Plant foods and dairy products are the main contributors of Sr^{90} to the human diet. The Sr^{90} body burden is dependent upon the composition of the diet. Dairy products generally contain a lower Sr^{90}/Ca ratio than do plant foods because the cow always puts into milk less of the strontium than of the calcium in the ration. This difference between dairy and plant foods will become greater with time after the cessation of testing. From a practical standpoint, the greater the proportion of dietary calcium coming from dairy products as compared to plant foods, the lower will be the Sr^{90}/Ca ratio of the diet.

Supplementation of dairy rations with uncontaminated calcium might be capable of reducing Sr^{90} levels in milk by a factor of two, but probably not more than a factor of four at most, because of abnormality of diets; stable strontium is not useful for this purpose. Supplementation of human diets with calcium does not appear feasible for the following reasons:

(a) to cause any appreciable reduction of body burdens of Sr^{90}, relatively high levels of uncontaminated calcium would have to be fed over long periods of time and

(b) the questionable benefit of any Sr^{90} reduction attained might well be outweighed by adverse effects on health caused by the high calcium intake.

This paper has reviewed some of the factors that can govern the radiation dose delivered to the human population by I^{131} and Sr^{90} from fallout. No inferences are intended as to the need, lack of need, or feasibility of applying any measures for reduction of population exposures under present circumstances. Rather, the attempt is stimulate the obtaining of knowledge so that any action needed in the future can be taken on a sound basis.