

Sample Pages from Antinuclear Nutrition's chapter on Pathways To Humans

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Pathways to Humans

Routes of Uptake

The internal human contamination by radionuclides can occur through several routes:

1. Inhalation
2. Absorption across intact skin
3. Penetration through wounds
4. Ingestion

Inhalation. The physical and chemical state of the radionuclides will influence the degree of uptake of inhaled radionuclides. Insoluble particles may reside in the lungs for quite a while before they are excreted. Cool, Cool, Brodsky, and Eadie (1979) measured the clearance of an accidental inhalation of an aerosol of insoluble iridium-192 from the lungs of two workers. They found that the half-time of the lung clearance of the insoluble metal was in excess of 700 days.

More volatile radionuclides, such as those of iodine, may be appreciably accumulated through the inhalation pathway without becoming trapped in the lungs. Studying twenty beagle dogs downwind of a fallout cloud, Fountain (1963) found that the thyroid uptake of radioiodines via the inhalation pathway was very rapid, since thyroid uptake averaged 92 percent of the amount of radioiodine inhaled by animals which were sacrificed immediately after the passage of the radioactive cloud. In addition he noted that the maximum buildup of radioiodines in the thyroid glands occurred on the second or third day following exposure; he

attributed that to the radioactive decay of the fallout particles which had been trapped in the respiratory and digestive tracts of the beagles during the cloud passage. The decay chains of the trapped particulates resulted in the production of some radioiodines that were not present in the original radioactive cloud.

In evaluating the relative risks of ingestion versus inhalation of radioiodines, Wehmann (1963) measured air concentrations and milk concentrations of iodine-131 that were deliberately released to the environment in a test of the Aircraft Nuclear Propulsion program. He found that the thyroid dose to a standard man would have been 0.03 millirads from inhalation, compared to the 4 millirads which would have resulted from drinking one liter per day of the milk from the same farm. In Wehmann's words, "the ingestion dose was 133 times the inhalation dose."

Another factor to consider is that an accumulation of particulate fallout on the ground may become resuspended in air by the wind. While fallout is relatively fresh, this pathway is about as important as the inhalation hazard from the original fallout cloud, or perhaps even more unimportant (Lasseby, 1980).

Absorption across intact skin. The passage of radioiodines across skin surfaces has been studied by Harrison (1963) who found that less than 1 percent of aqueous solutions of radioiodines, either as iodide or elemental iodine, crossed the skin surface. However, gaseous radioiodine was able to cross skin surfaces over the range of 1.2 to 78 percent of exposure dose, and this transport vector was facilitated by skin irritation. Burns, scrapes, or wounds would be likely to increase the intake of some radionuclides.

Penetration through wounds. Contamination of nuclear workers as a result of explosions or other accidents has occurred by penetration of the skin, but that