FACT SHEETS

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CENTER FOR HUMAN RADIOBIOLOGY

Fact Sheet on

Environmental Contamination from a Uranium Ore Processing Mill

This project was undertaken on behalf of the Division of Environmental Impact Studies and funded by the Nuclear Regulatory Commission to evaluate the impact on the environment of uranium ore processing mills and particularly of mill tailings piles.

A survey is being made of possible contamination of the biosphere that could affect humans in the neighborhood of uranium ore processing mills in New Mexico. This contamination is due to uranium and its long-lived decay products, ^{230}Th, ^{226}Ra and ^{210}Pb, as shown in the uranium series decay table (overleaf). Major factors (food chain, water and air) in human uptake of these materials are being studied and compared to those in control areas distant from the mill. Contamination may result from dust from the ore and processed uranium, and from dust and water from the tailing piles, which contain the residual activities from the processed ore. Radium-226 decays to the gas ^{222}Rn, which may then emanate from the tailings. The short-lived daughters of radon may contribute a relatively large dose to the lungs of people in the vicinity of the source, and the levels of ^{210}Pb deposited in the body may then be a measure of this dose.

The major emphasis has been on determination of the ^{226}Ra and ^{210}Pb levels using well-established analytical techniques in our laboratory. These nuclides will be determined in animals in the food chain, such as cattle, and rabbits, and to a lesser extent in fodder plants. The nuclides are contaminants in themselves, but in addition, atmospheric ^{222}Rn may be associated with the levels of ^{226}Ra. Uranium and ^{230}Th will also be determined in some of the samples. Measurements are being made on samples from animals, bone, stomach contents (rumen), muscle and various organs (e.g. liver, spleen and kidney).

Preliminary data on samples collected from a plot of land irrigated with uranium mine water, which is also mill process water, show that the levels of ^{210}Po (the alpha-emitting daughter of ^{210}Pb) and ^{226}Ra in cow dung and grass are 5 to 20 times higher than similar samples from a control area. Tissues from rabbits and prairie dogs near a tailings pile appear to have ^{210}Po concentrations about twice those from a control area. Other samples are being processed: tissues from two cows raised near a tailings pile fence and a similar set from a control area, and vegetables grown near a mill site. It should be noted that these samplings were made as extreme cases to assess the observability of effects.

From these studies we can ultimately estimate the levels of contamination in the human food chain produced by a mill. Insertion of these levels into metabolic models for the various nuclides will then make possible some assessment of the levels in man. This will indicate whether further studies are needed on samples (excreta, bone) from humans.

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REPOSITORY Argonne/CHR
COLLECTION Records Relating to Industrial/Medical
BOX No. Exposure to ~~Radiation~~ Radium
BOX 121 ASH
FOLDER Binder # 33 - CHR Fact
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History of CHR from ANL Reports

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Principal nuclides in the uranium series

Sub-series[1]	Element[2]	Mass number	Major mode of decay	Radioactive half-life
Uranium	Uranium	238	α	4.51×10^{9} yr
	Thorium	234	β	24.1 days
	Protactinium	234	β	1.17 min
	Uranium	234	α	2.47×10^{5} yr
Thorium-230	Thorium	230	α	8.0×10^{4} yr
Radium-226	Radium	226	α	1.60×10^{3} yr
Radon-222	Radon	222	α	3.82 days
	Polonium	218	α	3.05 min
	Lead	214	β	26.8 min
	Bismuth	214	β	19.7 min
	Polonium	214	α	1.64×10^{-4} sec
Lead-210	Lead	210	β	22 yr
	Bismuth	210	β	5.01 days
	Polonium	210	α	138 days
	Lead	206	none	stable

[1] Sub-series of radionuclides, based on half-lives or other properties.

[2] Each radionuclide is the parent of the following one.

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