

ABSTRACT

MEASUREMENT OF RADIATION DOSE TO LUNGS FROM RADON AND THORON DEGRADATION PRODUCTS

One of the important exposures of human subjects to ionizing radiation in the Atomic Energy Commission program occurs in the mining of radioactive ores. Today this hazard is associated primarily with radon and its airborne degradation products. A similar type of exposure to the degradation products of thoron may be important in the future.

This program is directed toward obtaining measurements of radiation dosage to the principal parts of the respiratory system of experimental animals breathing various atmospheres containing radon and thoron, to measure human retention of radioactivity in such atmospheres, and from such data to arrive at valid estimates of the dose to the various parts of the respiratory tract of human beings breathing such atmospheres. This program also aims at the development of methods for measuring integrated human exposure to radon, both as a monitoring procedure and for possible correlation with lung cancer incidence among a population of miners exposed to radon contrasted with a normal control population.

An eventual product of the radioactive decay of radon is radiolead with a 20 year half-life. Previous work in this program has shown that storage of radiolead occurs in the bodies of individuals exposed to radon up to 100 times as much as in similar tissue samples from persons with no history of radon exposure; and that polonium, produced in turn from radiolead, appears in the urine since urine from active miners contains up to 100 times as much polonium as urine from laboratory personnel. Potentially therefore polonium in urine can be used to measure integrated previous radon exposure in living individuals and the radiolead content of autopsy specimens can also be used to measure the individual's previous exposure to radon. Additional information on the sites of deposition and rate of excretion from the human body burden of lead derived from radon are needed. Radiolead in autopsy specimens is determined by measuring the polonium produced by its radioactive decay.

In cooperation with the U.S. P.H.S. (Mr. Duncan Holaday), the Grand Junction Veterans Administration Hospital (Dr. Stanley Crosbie) and the Union Carbide Nuclear Co. (Mr. Arthur Schaeffer) four adult beagle dogs were placed in the CFC mine near Uravan, Colorado last November. After several months' exposure in an area of relatively high radon and radon daughter concentrations, they will be returned to Rochester for measurement of polonium excretion and the biological half-life of radiolead as a function of time after exposure.

Two adult beagle dogs were given high radon exposures in a new radon exposure chamber here at Rochester in a joint experiment with the Radioactive Inhalation Section. Polonium and radiolead excretion is being followed in these animals exposed to a known amount of radon. In terms of activity, these two dogs excreted 16-38 times as much radiolead as polonium the first two days after exposure. This activity ratio had dropped to 5-10 within two weeks and has remained the same for the following four weeks.

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Mice exposed to radon at various dosages up to two years prior to death or sacrifice were analyzed for polonium and radiolead content. The data indicate that the effective half-life of radiolead is long (approximately 700 days) even in this species.

Polonium analyses were made, and radiolead determinations are being done on human autopsy material forwarded by Dr. Geno Saccomanno, Grand Junction, Colorado and on human autopsy specimens obtained at Rochester from cases with no recorded history of exposure to naturally occurring radioactive materials. Sternum and rib specimens of one case from Grand Junction show polonium contents ranging from 2,850 to 4,350 micromicrocuries per kilogram fresh tissue contrasting with values of 4 to 75 from similar material obtained at Rochester.

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DOE ARCHIVES

AEROSOL STUDIES IN MAN AND DOG

P.E. Morrow and F. Gibb

Comparative studies on the deposition of various "carrier" aerosols in human and canine subjects are continuing. Seventeen studies on seven human subjects with a NaCl aerosol (CMD 540 Å σ_g 2.25) resulted in 63.4% mass deposition (95% confidence limit for mean, 57-69%). In five studies on two dogs, the mass deposition values and the role of various physiologic factors appear to be quite similar. Two experiments wherein the sodium chloride was aerosolized as a carrier for polonium²¹⁰ have been completed. Plans are being completed for the exposure of dogs to plutonium aerosols.

500 Å (unpublished)
99.5% < 4500 Å
20 mg/m³

7 males 64%
(17) (57-69)
2 dogs ♀ > 60%
(5) 45-78