

1/27/67

Investigator

Annual Report No. 13

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Retention and Translocation of Inhaled Calcined
Promethium Oxide in Beagle DogsTech. Asst.

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Abstract

Four dogs were exposed to aerosols of recalcined $^{148m} + ^{147}\text{Pm}_2\text{O}_3$ particles. Whole body counting rates showed biological half-times of 450 to 590 days. At 5-1/2 months after exposure 44% of the body burden was in the lungs, 24% in the skeleton, and 22% in the liver. Pulmonary retention half-times ranged from 210 to 540 days.

Introduction

In an earlier study six beagle dogs were exposed to aerosols of calcined $^{147}\text{Pm}_2\text{O}_3$ which was neutron-activated to produce a 20:1 ratio of ^{147}Pm to ^{148m}Pm , the latter providing a 0.6 Mev gamma emission for whole body monitoring. However, the relatively high solubility (3 to 4% determined by dialysis) of the promethium oxide in 0.1% pluronics suspension used for aerosol generation and the apparent translocation of some radioactivity to the abdominal region (inferred from longitudinal scanning) within a few days after exposure, suggested the need for further experiments. Accordingly, four additional beagle dogs were exposed to aerosols of promethium oxide prepared by recalcining the neutron fluxed material used in the earlier study.

REPOSITORY PNL, ENG. BLDG.
AREA 3000

COLLECTION PROMETHIUM

BOX No. 2947

FOLDER HSC 66-1

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Observations

Forty-five to 80% of the initially deposited promethium was cleared (almost exclusively by the fecal route) during the first week after exposure. Figure I shows the whole body retentions of inhaled promethium oxide. By 2 weeks after exposure the early phase of clearance was virtually complete. Effective half-times for whole body retention 14 to 120 days after exposure were 590 and 450 days for dogs 1, 2, 3, and 4, respectively. These compare with the earlier experiment in which whole body retentions on the order of a year or longer were found with six dogs.

Longitudinal scans of dog 1 at 2 weeks and 4 months after exposure are given in Figure 2. The dotted lines correspond to scans of a beagle phantom containing sixteen $^{148}\text{m} + ^{147}\text{Pm}$ sources placed exclusively in the "lungs". While the radioactivity peak was virtually confined to the lungs 2 weeks after exposure, by four months it had extended partially into the abdominal region indicating a gradual translocation to other organs. This translocation was verified by radioactive analyses of the tissues of dog 1 following sacrifice at 5-1/2 months after exposure, Table I. Promethium accumulated in the tracheobronchial lymph nodes, with about half of the body burden remaining in the lungs, and 20-25% translocated to both liver and skeleton.

The regression curves in Figure 3 were obtained by planimeter measurement of the areas under the lung regions of longitudinal scans such as those of Figure 2. Although the 42-day physical half-time of $^{148}\text{m} \text{Pm}$ is shorter than desirable for long term studies, the curves of Figure 3 describing pulmonary retention of promethium in these four dogs show remarkably close fitting to the points

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representing measured areas of lung scans. Estimated half-times for pulmonary retention range from 210 to 540 days.

Conclusions

Longitudinal scans of these animals showed the typically localized lung peaks for one or two months after exposure of a very insoluble inhaled radionuclide, compared to considerable translocation to the abdomen of within a few weeks of the non-recalcined promethium oxide used in previous studies. However, the rapid approach of whole body counting rate slopes to physical radioactive decay indicates long term retentions with half-times of about one to two years for inhaled recalcined promethium oxide, which are the same retention times as shown for the non-recalcined oxide. Translocation of promethium-147 equally to liver and skeleton reduced the lung burden to 44% of the total body burden at one-half year after exposure, following the same general pattern of distribution as inhaled promethium perchlorate (determined by earlier work in this laboratory) but with much greater pulmonary retention.

Encls.

Table I

Figures 1 -

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Table I. Tissue Distribution of ^{147}Pm in Dog 1 at
146 days after Inhalation of Calcined $^{148}\text{m} + ^{147}\text{Pm}_2\text{O}_3$.

<u>Tissue</u>	<u>Percent Body Burden at Sacrifice</u>
Tracheobronchial lymph nodes	3.3
Lungs	44.3
Spleen	0.02
Kidneys	0.6
Liver	21.8
Bone	23.5
Gastrointestinal Tract	0.3
Muscle	1.6
Skin	0.9
Other	4.0

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