

PRIVATE & CONFIDENTIAL

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RADIOACTIVITY IN TOBACCO AND SMOKE

(Polonium 210)

A recent publication (Radford & Hunt) showed that Polonium 210 was present in tobacco and transferred into mainstream smoke. The American figures indicated that:

The tobacco can contain approximately 0.3 - 0.5 p.c. per cigarette.

Smoke can contain up to 0.12 p.c.

Transfer from tobacco to smoke was of the order of 25%.

Recovery of polonium 210 activity over the whole experiment was of the order of 80-90%.

Radford and Hunt also carried out assays at specific sites in the human lungs. They concluded that the polonium content of smoke represents a considerable hazard to the smoker.

As a result of these implications, and following a suggestion by Sir Charles Ellis, discussions were held at Sutton and Southampton with Professor W.V. Mayneord, and Drs. Hill and Turner. Mayneord and Hill believe that Radford and Hunt are reliable experimentalists, and thus their results are not to be treated lightly; Mayneord's only quarrel is with the calculations for dose rates. Both Hill and Turner have been interested in polonium 210 for some little time and had already carried out some experiments on commercially available cigarettes. Their early results (see appendix) showed:-

- (i) they agreed with the American figures for the tobacco contents;
- (ii) they did not agree with the American smoke figures; Hill's transfer figures are 2 to 3 times lower than the American figures;
- (iii) the Gold Leaf filter may be about 44% efficient for polonium. It should be noted that the cigarettes were smoked down to the filter, and consequently the efficiency will be high due to 'hot filtration'.

Consequently, it was agreed that Professor Mayneord's people should repeat the work under standardised conditions, to determine a material balance and transfer efficiency of the polonium 210. F. S. D.F. was to be responsible for providing smoking facilities etc., and Mr. P.N. Richardson delegated to be the liaison scientist.

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On March 11th, the first collaborative experiment was carried out at Sutton, using cigarettes made from CN.102 blend tobacco. These cigarettes were smoked to a 23 mm. butt, at one puff a minute, each puff of 35 ml. volume and 2 seconds duration. Cambridge filters were used to collect sidestream and mainstream smoke, and the ash and butts were also collected for assay.

The first results show that the cigarettes contain an average of 0.47 p.c. activity per cigarette. After smoking the activity was divided as follows:-

Ash	Butt	Mainstream	Sidestream
18%	31%	5%	12%

Hill considers that his recovery from the Cambridge filters is low and he is repeating the work using other forms of collection.

In addition, Hill was also able to obtain a number of autopsy samples of lung of smokers and non-smokers. He has been measuring samples, which of necessity are larger than those used by the American workers. The reason for this is that the equipment at Sutton has a higher background of 3 to 4 counts per hour compared with a half to one and a half of Radford & Hunt. Hill is of the opinion that "although they have not yet done sufficient samples for a proper statistical analysis, it appears that there is little difference between the smokers and non-smokers". It should be borne in mind that Radford and Hunt did not measure lungs from non-smokers.

The chemical and physiological work at Sutton is now continuing.

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Measurements of Po<sup>210</sup> in Cigarettes and Cigarette Smoke

48 "Gold Leaf" (filter tip) cigarettes were smoked at a rate of one 2 second puff per 40 seconds until the tobacco had been burned down to the filter (16 puffs). Smoke was collected by bubbling through two wash bottles in series, each containing a mixture of .1N H61 in ethyl alcohol and immersed in a dry ice/acetone mixture.

Po<sup>210</sup> measurements were made as follows:

- (1) & (2) Contents of each trap separately
- (3) Reagent blank on acid alcohol mixture  
(bubbled with air only).
- (4) Ash from the smoked cigarettes
- (5) Filters from the smoked cigarettes
- (6) Unsmoked tobacco from raw cigarettes
- (7) Clean filters from raw cigarettes

The net activity found per cigarette in each case was as follows (american results in parenthesis).

		<u>Picocuries</u>	<u>% of total</u>
Tobacco in unsmoked cigarette.		0.395 (0.42)	
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Contents of trap 1	0.031		
"    "    "    2	0.003		
Total in traps ("mainstream smoke")		0.034 (0.10)	9 (24)
Side-stream smoke	not measured	(0.10)	- (24)
Ash		0.095 (0.038)	2.5 ( 9)
Used filter	0.034	(0.12)	(29)
New filter	0.007		
Net gain by filter		0.027	7
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Total Recovery		0.156 (0.36)	40 (86)

C. R. Hill  
18th Feb. 64

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