DEPARTMENT OF MINES
SOUTH AUSTRALIA.

GAMMA RADIATION FROM DRUMS OF PRODUCT LOADED FOR TRANSPORT.

by

A.S. Wilson, Biophysicist.

TABLE OF CONTENTS.

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GAMMA RADIATION FROM DRUMS OF PRODUCT LOADED FOR TRANSPORT.

ABSTRACT.

Dose rates found along the side of a loaded truck and simulated semi-trailer did not exceed two millirontgens per hour; on top they reached 2.5 millirontgens per hour, but in the cabin all were below one millirontgen per hour.

INTRODUCTION.

On a further visit to the Uranium Treatment Plant, Port Pirie, on the 18th. and 19th. July, 1957, radiation dose rates were measured in the vicinity of drums of product loaded for transport by road. An Ekco Portable Radiation Monitor, type 1132A was used (as previously.).

A semi-trailer as supplied by Lee Transport Company Limited, and a 3-ton Austin truck are normally employed to cart product short distances by road. Each load usually consists of one complete lot of 50 drums (though the drums measured on this occasion came from two lots.). The semi-trailer used most often appears to be an International, but other types may occasionally replace this. The semi-trailer carries 34 to 36 drums, usually 35, while the Austin truck takes 14 to 16, usually 15.

SAMPLING

Method.

The tests were carried out on the factory-owned Austin truck and a simulated semi-trailer, in the Pentad store building.

Measurements made on an International semi-trailer ($4\frac{1}{2}$ ton) during a visit to the Lee Transport Company's depot showed a ten inch thickness of cabin, including steel back, about $1\frac{1}{2}$ inches of wood, then coiled springs supporting a leather backrest. A further three feet one inch separated the front of the tray from the back of the cabin, i.e., a total distance of approximately four feet to the driver's seat.

To save time, drums were loaded, four at a time, on pallets, (which were left in position,) using a fork-lift, and measurements were made in the driver's cabin at regular intervals during loading (usually after each addition of four drums) to obtain the limiting value for radiation received there. Measurements were also made of dose rates at intervals during loading along the sides and top of the Austin truck and simulated semi-trailer.

After completing measurements on the Austin truck as ordinarily loaded, drums on this truck were re-arranged three feet back from the cabin, and additional rows stacked on benches behind these rows to simulate the geometrical arrangement of drums on an International semi-trailer (but the Austin cabin was left unchanged). As distances involved with other semi-trailers would usually be greater, and thicknesses and densities of cabin materials similar, dose rates received in the driver's cabin on other semi-trailers are not thought likely to be significantly in excess of those existing under the conditions measured.

All readings were taken with one monitor, C72, as the second monitor, C104, was found to be functioning incorrectly.

Results.

Background reading - zero.

Cabin measurements -

Austin truck - Drums against back of cabin.

Cabin Position.		Driver's Seat	Centre	Left-hand side.
		Millirontgens per hour.		
4 drums (loaded on left	back	0.3		0.4
	head			
8 drums (2 rows of 4)	back	0.5		0.5
	head			
12 drums (8 on left)	back	0.5	0.6	0.7
	head	0.7	0.7	0.7
16 drums (4 rows of 4)	back	0.6	0.7	0.7
	head	0.7	0.7	0.7

Simulated semi-trailer.

On moving these 16 drums three feet back from the cabin, to simulate semi-trailer conditions, cabin dose rates became:

Position		Driver's Seat	Centre	Left-hand side
		Millirontgens per hour.		
16 drums	back	0.5	0.5	0.5
	head	0.5	0.5	0.5
36 drums.	back	0.5	0.6	0.5
	head	0.5	0.6	0.6

Austin Truck,

Side measurements - Front to rear.

	Left Site	Right Side.
	Millirontgens per hour	Millirontgens per hour.
8 drums	0.8	0.9
	0.6	0.9
16 drums	0.9	0.9
	0.7	1.0
	1.0	1.1
	0.9	1.1

Rear (left to right) 1.o, 1.1, 1.3, 1.1 millirontgens per hour.

Top (left to right, front to rear)

Millirontgens per Hour.				
0.8	0.9		0.9	0.8	Reading in space
0.8	0.9		1.0	0.9	marked X = 0.9
0.8	0.9	X	1.2	1.1	millirontgens per
0.7	0.9		1.0	1.0	hour.

At back of truck 0.4 millirontgens per hour.

Centre of back of truck 0.5 millirontgens per hour.

Simulated Semi-trailer.

Side measurements - front to rear.

Left Side			Right Side.		
32 drums	36 drums	maximum.	32 drums	36 drums	Maximum.
Millirontgens per hour.			Millirontgens per hour.		
0.8	0.8	1.0	1.0	1.0	1.4
1.0	0.9	1.0	1.1	1.1	1.4
1.1	1.0	1.2	1.1	1.2	1.5
0.9	0.9	1.0	1.2	1.3	1.5
1.3	1.2	1.5	1.5	1.5	1.8
1.3	1.3	1.6	1.5	1.4	1.7
1.3	1.3	1.7	1.5	1.6	1.8
1.2	1.4	1.7	1.3	1.5	1.7
	1.3	1.5		1.4	1.5

Rear (left to right) 1.3, 1.5, 1.4, 1.4 millirontgens per hour.

Rear (maximum) 1.3, 1.5, 1.4, 1.4 millirontgens per hour.

Top. (Left to right, front to rear) (Millirontgens per hour.)				Lot and Drum Nos. (Showing Arrangement.)			
1.5,	1.5,	1.5,	1.5	Z36.2,	Z36.8,	Z36.6,	Z35.36
1.5,	1.8,	1.7,	1.6	Z36.5,	Z36.1,	Z36.7,	Z36.3
1.6,	1.7,	1.9,	1.9	Z35.35,	Z364,	Z35.31,	Z35.34
1.6,	1.9,	2.0,	2.0	Z36.9,	Z36.10,	Z35.32,	Z35.33
2.0,	2.3,	2.2,	2.0	Z35.29,	Z35.11,	Z35.24,	Z35.21
2.0,	2.2,	2.0,	2.0	Z35.30,	Z35.22,	Z35.27,	Z35.28
2.1,	2.3,	2.3,	2.4	Z35.26,	Z35.20,	Z35.18,	Z35.13
2.1,	2.3,	2.5,	2.1	Z35.25,	Z35.23,	Z35.12,	Z35.16
2.1,	2.2,	2.0,	2.1	Z35.14,	Z35.15,	Z35.17,	Z35.19

Zero drift of perhaps 0.5 millirontgens per hour may have affected these top readings, but time did not allow a recheck.

Maximum represents the highest of a series of readings which include different positions of the monitor on the drum and electronic variations.

Dose rate at a distance of -

(a) Five feet from the sides: 0.9 millirontgens per hour.

(b) Five feet from the rear: 0.8 millirontgens per hour.

Summary of Results:

1. Radiation dose rates as measured in the driver's cabin of the Austin truck and simulated semi-trailer were all found to be below one millirontgen per hour. (Maximum dose rate found was 0.7 millirontgens per hour.)

2. Similar low values (or even lower ones) could be expected at the probable distances of other vehicles from the load.

3. Dose rates along the sides and rear of the truck and simulated semi-trailer were found to vary from below one millirontgen per hour to a maximum of two millirontgens per hour. Top readings nearer the centre of the massed drums were found to reach up to 2.5 millirontgens per hour.

CONCLUSIONS.

The dose rates found are well below the maximum permissible level for external gamma radiation (7.5 millirontgens per hour), so that they are unlikely to have any adverse effect on an individual unless he is receiving additional doses of radiation from other sources.

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BIOPHYSICIST.