[redacted] DR-1777-9 HW-3-3455

2,3,4 - A.E.C. - HW
Att: A. E. Gorman
→ #5 - Extra
#6 - Extra
#7 - Extra
#8 - Extra

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TO: J. W. Healy
Sr. Supv. Special Studies
Medical Dept. (H. I.)

March 1, 1946

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HW--3-3455

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I^{131} Accumulation in the Thyroid of Sheep Grazing near H.E.W.

I. Introduction

The deposition of radio-iodine on vegetation in the vicinity of the reservation has led to the question of possible damage to animals feeding on this land. The contamination has been extensive only in the immediate region of the Plant, but some activity has been found as far as 80 - 100 miles from the stack.(1)(2)(3)(4)

The tolerance figure for I^{131} on vegetation has been set at 0.2 μc/kg for all animals.(5) A more specific figure for sheep would be on the order of 0.4 - 0.5 μc/kg.(5) The tolerance amount of iodine in the thyroid of a sheep (20 gms) may be calculated as 1.6 μc. All of these quantities are conveniently measurable with the instruments available to the H. I. Section. The limit of detection on vegetation is about 0.03 μc/gm; while in the thyroid with portable instruments it is about 0.1 μc.

The following measurements on thyroid activity of sheep in regions adjacent to the Plant were obtained under conditions which avoided the excitement of public curiosity. The H. I. Section is indebted to the Area Engineer's office for making this possible.

I. Summary

Most of the animals investigated had been on dry feed for periods of two to ten days preceding the measurements. Every animal measured had some iodine present, as was shown by a decided increase in the count when the GM tube was placed near the thyroid. The amounts ranged from a maximum of one μc on an animal at Robert's Ranch northeast of the 200 Areas, to a minimum of

E. G. Baker 4/8/86
C. Patterson

0.1 μc/at Benton City and across the Columbia River. A brief summary of results is given in the following table: tabulated, 3 & 10

Radio-Iodine Content of Sheep Thyroid

Location	No. of Animals Checked	Thyroid Activity Average μc	Thyroid Activity Maximum μc	Estimated Average Daily on Range μc	Range Vegetation μc I^{131}/kg	Calculated Activity in Thyroid μc I^{131}
4 Mi. SW Yakima Barricade	4	0.6	1.0	1.4	0.1 - 0.3	0.3 - 1.0
3 Mi. E. of Benton City	3	0.2	0.25	0.7	0.4	1.0
Lambing Pens-Benton City	4	0.4	0.6	0.5	0.4	1.0
4 Mi. NW from 300 Area	6	0.2	0.3	0.2	0.08 *	0.25

The rather good agreement between observed and calculated thyroid activity substantiates the provisional calculations on this point. Measurements of ground contamination can therefore be used with reasonable accuracy to deduce the average thyroid activity of farm animals.

III. Procedure

Two instruments were used. One was a small, low voltage, gamma counter equipped with earphones. The counting rate was measured by counting individual clicks over a one-minute time interval. The second instrument was a standard portable GM counting rate meter. This instrument is connected by a 3-ft. cable to a probe containing a GM tube shielded by aluminum 1/16 in. thick.

Both instruments were calibrated by use of an "artificial thyroid" made by embedding a bi-lobed glass bottle, of 25 cc. capacity, 1/8 in. beneath the surface of a solid cylinder of paraffin. The "thyroid" was then filled with 25 ml. of a standardized I^{131} solution. Readings were made on the "thyroid" with both instruments by holding the tube against the paraffin, at a tangent to each lobe. The smaller instrument was calibrated with charges from 0.1 to 0.3 μc, to give an average of about 200 c/m per μc. The standard portable GM set was calibrated on the most sensitive scale with charges from 0.3 μc to 1.0 μc, to give an average of about 20 μ Amp per μc. Since the average depth of thyroid in sheep is probably greater than 1/8 in. (considering wool, skin, connective tissue, flesh, etc.), the estimated activity may be low by a factor of 1.2 to 1.3.

The method of check minimized the shielding effect. The wool was parted at

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* Estimating 80% dry feed at 0.05 μc/kg and 20% range feed at 0.2 μc/kg.

the desired region, and firm and continuous pressure was applied on the instrument. Checks were made on the two sides of the neck with background checks at the top portion of the neck and in the flank. Where two readings are shown, the higher is used, since it is presumed to be closer to the thyroid. The backgrounds subtracted from the readings are always those taken on the neck.

Station 1 was the Robert's Ranch, located about 4 miles southwest of the Yakima road Barricade on the Benton-Yakima County line. Only ewes that had been on dry feed (baled alfalfa and grain) for 10 days were available for examination. No feed samples were taken.

Tabulation of Results (Date: 2/25/46 11:00 A.M.)

Sheep #	Background Flank	Background Neck	Net Readings	Estimated μc	Estimated μc 10 days earlier if feed was not contaminated
Ewe 1	24 c/m	24 c/m	30, 33 c/m	0.16	0.38
Ewe 2	4 μ A	6 μ A	16, 21 μ A	1.0	2.4
Ewe 3	4 "	5 "	9, 11 "	0.5	1.2
Ewe 4	4 "	4 "	12, 14 "	0.7	1.7
			Average	0.60	1.44

Station 2 was the farm of H.B.Burlew, three miles north of Benton City. Ewes had been replaced on pasture either the day the check was made (2/25/46) or on the previous day. Previous to being replaced on pasture, the animals had been on dry alfalfa for 2 weeks. Pasture consisted of short green alfalfa shoots, supplemented by smaller amounts of early green grass, dry alfalfa stubble, corn stalks and various dry wild grasses. A sample of green alfalfa showed an activity of 0.05 μc/kg, and a sample of green grass (probably brome grass) showed an activity of 0.1 μc/kg.

Tabulation of Results (Date: 2/25/46 3:00 P.M.)

Sheep #	Background Flank	Background Neck	Net Readings	Estimated μc	Average μc
Ewe 1	27 c/m	30 c/m	17, 25 c/m	0.12)	0.13
Ewe 1	5 μ A	5 μ A	3 μ A	0.15)	
Ewe 2	4 μ A	4 μ A	4, 5 μ A	0.25	0.25
			Average		0.2

Station 3 was H.B.Burlew's lambing pens on the eastern limits of Benton City. Sheep had been driven in from range (south of Benton City) two days earlier.

Tabulation of Results (Date: 2/25/46 3:30 P.M.)

Sheep #	Background Flank	Background Neck	Net Readings	Estimated μc	Average μc
Ewe 1	4 μ A	4 μ A	7, 9 μ A	0.45	0.45
Ewe 2 *	26 c/m	26 c/m	75 + c/m	0.38	
Ewe 2	5 μ A	5 μ A	12 μ A	0.60	0.5
Ewe 3	4 μ A	4 μ A	3 μ A	0.15	0.15
				Average	0.4

(* Reading on instrument probably low due to upper limit of range.)

Station 4 was the flock of Ray Hooper, located about one mile east and three miles north of the 300 Area. Four ewes and two rams were checked. All had been on the range until the previous day, but their rations had been greatly supplemented with alfalfa hay for the past two weeks. A sample of alfalfa from a feed trough showed an activity of 0.05 μc/kg.

A rather lean milk cow was briefly checked to show a net reading of about 15 to 20 c/m or less than 0.1 μc. She refused to stand for a complete and accurate count.

Tabulation of Results (Date: 2/26/46 11:00 A.M.)

Sheep #	Background Flank	Background Neck	Net Readings	Estimated μc	Average μc
Ewe 1	27 c/m	24 c/m	25, 31 c/m	0.16	
Ewe 1	4 μ A	4 μ A	2 μ A	0.1	0.13
Ewe 2	30 c/m	27 c/m	40 c/m	0.2	
Ewe 2	4 μ A	4 μ A	3 μ A	0.15	0.18
Ewe 3		28 c/m	30, 33 c/m	0.17	
Ewe 3	4 μ A	4 μ A	3 μ A	0.15	0.16
Ewe 4		28 c/m	33 c/m	0.17	
Ewe 4	4 μ A	4 μ A	3 μ A	0.15	0.16
Ram 5	24 c/m	26 c/m	56, 60 c/m	0.3	
Larger)		3 μ A	5 μ A	0.25	0.28
Ram 6					
Smaller)		25 c/m	25 c/m	0.13	0.13
				Average	0.2

The agreement between experimental observations with the two types of counters confirms the relative initial laboratory calibrations.

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XV. References

(1) "H. I. Report on the 200 Areas and Environs for the Week Ending 1/9/46" Doc. #7-3194 dated 1/11/46 - C.C.Gamertsfelder to W.C.Kay

(2) "H. I. Report on the 200 Areas and Environs for the Week Ending 1/16/46" Doc. #7-3235 dated 1/17/46 - C.C.Gamertsfelder to W.C.Kay

(3) "H. I. Report on the 200 Areas and Environs for the Week Ending 2/13/46" Doc. #7-3432 dated 2/14/46 - C.C.Gamertsfelder to F.B.Vaughan

(4) "H. I. Report on the 200 Areas and Environs for the Week Ending 2/20/46" Doc. #7-3477 dated 2/21/46 - C.C.Gamertsfelder to F.B.Vaughan

(5) "Tolerable Concentrations of Radioactive Iodine on Edible Plants" Doc. #7-3217 dated 1/14/46 - H.M.Parker to W.D.Norwood

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