Fax Cover Sheet

Headquarters United States Air Force
Office of the Air Force Surgeon General

TO

Date: 3 May 93	Time:
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Organization/Office Symbol: AL/CFTF	
Person to Contact: Dr. Crock	
Phone Number to Call for Pickup: 3811	
Subject: Request for Info - Hypothermia	

Comments:
One more sheet. Thanks for your help.
SGPz

FROM

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Total Number of Pages Including Cover Sheet: ~~4~~ 1

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No. of Pages: 18 **(including cover sheet)**

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Date: 4 May 93

Message:

Here is the information - I have extracted the Introduction part of the Methods and the Summary and Conclusion. Also I have included tables 7-12 which contain the dosages I^{131} (labeled isotope) (circled) and the uptake percentage of I^{131} after 24 hrs.

I hope this helps you out in getting info for your Steve.

Larry P Krock PhD

THYROID ACTIVITY IN MEN EXPOSED TO COLD

INTRODUCTION

It is well established that some animals exposed to severe cold show marked changes in the thyroid. Histologically, there is evidence of increased activity (1). Evidence of thyroid stimulation during cold exposure has been obtained using radioactive iodine in rats (2, 3). It has been concluded that the observed hyperactivity of the thyroid indicates that there is an increased metabolism in cold which can be attributed to chemical regulation (4). It has also been suggested that the thyroid gland is involved in human acclimatization to cold (5).

Ingbar et al. (6) observed changes in five men continuously exposed for 12 days to 13° C. (55° F.) while wearing only cotton underwear, which they interpreted as indicating: "the ability of environmental factors to modify bodily requirements for thyroid hormone" in man.

This cold stress was probably far more severe than what is normally encountered in regular life in a cold climate or even during successful emergency survival in the Arctic.

In view of this, it was considered desirable to assess the role of the thyroid in man during the cold exposure usually encountered during normal arctic living or operations and during simulated emergency survival in the cold.

METHODS AND MATERIAL

General

Tracer doses of up to 65 microcuries I^{131} were used to determine the thyroid uptake, urinary and salivary elimination, total plasma and protein-bound I^{131}, using sensitive scintillation counters as part of a complete mobile isotope laboratory which could be transported to remote areas of Arctic Alaska.

The study, furthermore, included careful clinical examination, estimates of dietary iodine intake, and environmental exposure records.

In 46 cases, the procedure was repeated in the same subjects at different seasons of the year.

The subjects included groups considered to be exposed to considerable cold, such as coastal and inland Eskimos, two groups of Athapascan Indians of Fort Yukon and Arctic Village, and white controls including a group of Army soldiers who were regularly engaged in outdoor activities even during severe cold,and a group of Air Force technicians who spent most of their time indoors.

Furthermore, the thyroid activity was assessed in a group of Caucasians before and after a controlled, 4-week, rather severe field exposure program simulating an arctic emergency survival situation. This group was continuously exposed to environmental temperatures between 10° F. and -30° F. and considerable wind (mean wind chill factor 1000 Cal/m²/Hr.), living in unheated snowhouses or tents, and being engaged in outdoor activities most of the day.

Finally, a separate, more detailed study was made in a group of infantry soldiers and coastal Eskimos to determine blood levels of I^{131} from 6 to 48 hours following the tracer dose.

A total of 200 tracer experiments was made in 19 Whites, 64 Eskimos, and 17 Indians. Analyses of variance and allied tests of significance were applied to the data.

Procedures

The subjects were given a standardized dose of carrier-free I^{131} in capsule form (supplied by the Abbott Laboratories) before breakfast together with a cup of water.

It was attempted to keep the individual tracer dose of I^{131} as close to 50 microcuries as possible, but due to the long distance from the source of supply (Oak Ridge, Tennessee) and transportation difficulties in the remote areas of Alaska, delays due to bad weather, etc., the dosages varied considerably. Thus, in one case, doses as low as 9 microcuries had to be used.

The thyroid uptake was determined by means of a scintillation detector connected with a scaler. (Directional scintillation detector, Nuclear Chicago Model DS-1; well-type scintillation detector Model DS-3; Nuclear Chicago scaling unit Model 183 and Radiation Counter Laboratories scaler mark 13 Model 10A). The efficiency of one detector and the scaler was checked semiannually using a standard source of Co^{60}. The detector, with the directional shield removed but covered with a lead plate 1 mm. thick, was positioned in front of the subject's neck at a distance of 15 inches. On the basis of these data, the background counts and the reading of a standard capsule in a phantocube (Abbott Laboratories), the percentage of the given dose taken up by the thyroid gland was determined.

Urinary elimination of I^{131} was determined by instructing the subjects to collect all urine during the test periods. Of the entire specimen 5 ml. were pipetted out and counted in a well-type scintillation detector, and the activity compared with that of 5 ml. of a standard solution of I^{131}.

The standard solution contained the equivalent of the tracer dose given to the patient, dissolved in 1 liter of distilled water to which a small amount of potassium iodide was added to facilitate solution of the radioactive iodine. On the basis of the activity of the 5 ml. sample and the total volume of the entire urine specimen, the percentage of the given dose eliminated through the urine could be calculated.

As a rule, the thyroid uptake and the urinary elimination of I^{131} were determined 6, 12, 24, and 48 hours following the tracer dose. In some cases the thyroid uptakes and urinary eliminations were followed for 168 hours (table XVII).

Total plasma I^{131} and protein-bound I^{131} were routinely determined 24 hours following the tracer dose. From a 12 ml. blood sample, 5 ml. of plasma were transferred to a centrifuge tube and read in the well-counter. The 5 ml. plasma sample was then treated as follows: 1.5 ml. 40 percent trichloracetic acid was added and stirred with a glass rod, and the sample centrifuged at 2,000 r.p.m. for 4 minutes. The supernate liquid was poured off and the precipitate was washed with 5 ml. of 10 percent trichloracetic acid three times. Distilled water was then added up to a total volume of 5 ml. and the sample was counted in the well-counter and compared with a 5 ml. sample of the standard solution of I^{131}. The product of the total efficiency of the counter and the net counts per minute of 5 ml. of plasma or 5 ml. of PBI^{131} times 200 gave the net microcuries of inorganic I^{131} or PBI^{131} per liter of plasma, respectively. The results were expressed as percentage of the given dose per liter of plasma.

Twenty-four hours after the tracer dose was given, the saliva sample was obtained by having the subject collect the saliva in a test tube over a period of 10 minutes. This was taken as an indication of the salivary flow. The subjects were instructed passively to collect the normally occurring saliva, without any attempt of stimulation. In most cases the saliva specimen was collected in the morning after breakfast.

Three milliliters of this saliva were pipetted out and counted in a well-counter, compared with a 3 ml. standard solution of I^{131} and the net microcuries of I^{131} per liter of saliva was determined. The results were expressed as the percentage of the given tracer dose in 1 liter of saliva.

Water, food, and urine specimens. In order to obtain an estimate of iodine intake and elimination, specimens of the more important food items, drinking water, and 24-hour urine specimens were collected at the different locations, frozen, and shipped back to the laboratory for analysis.

Part of the food and urine specimens was shipped frozen to the thyroid laboratory of the Massachusetts General Hospital for routine analysis. The rest was analyzed in our laboratory (Dr. Horace F. Drury, Department of Biochemistry) as follows: Urine and food samples were digested with chloric acid by the Leffler method as described by Reals et al. (7). The iodine content was then determined by a modification of the ceric ion method described by Brown, Reingold and Samson (8). The ceric ion method was also used for the determination of iodine in the drinking water. The results are given in tables XXXV and XXXVI.

PBI and serum cholesterol. In a number of cases, fasting blood samples were taken for the analysis of serum cholesterol and protein-bound iodine. The serum was frozen in the field and returned to the laboratory. The protein-bound iodine was determined routinely by the Biochemical Procedures Laboratory in California, using the method of Barker et al. (10).

TABLE VII

THYROID UPTAKE OF I^{131} 24 HOURS FOLLOWING THE TRACER DOSE IN WAINWRIGHT ESKIMOS (INITIAL STUDY)

Subj. No.	Name	Race	Sex	Age	Date	Dose I^{131} Micro-curies	Thyroid Uptake in Percent of Tracer Dose 24 hours following dose
1	ANASHUGAK, Ward	1/1 Eskimo	M	33	August 1955	12	42
2	AHLALOOK, Ralph	1/1 Eskimo	M	54	August 1955	14	22
3	AUDLAKSAROAK, Peter	1/1 Eskimo	M	65	August 1955	14	39
4	BODFISH, Waldo	1/2 Eskimo	M	54	August 1955	12	32
5	EKAK, Wesley	1/1 Eskimo	M	58	August 1955	14	18
6	KAGAK, Morris	1/1 Eskimo	M	25	August 1955	14	30
7	EKAK, Bob	1/1 Eskimo	M	26	August 1955	14	34
8	ANGASHUK, Oliver	1/1 Eskimo	M	49	August 1955	12	20
9	AKADNAK, Grouse	1/1 Eskimo	M	40	August 1955	14	46
10	JAMES, Robert	1/1 Eskimo	M	54	August 1955	12	9*
11	KAYUTUK, Michael	1/1 Eskimo	M	58	August 1955	14	36
12	KAGAK, William	1/1 Eskimo	M	57	August 1955	14	18
13	MATOOMALOOK, Andrew	1/1 Eskimo	M	36	August 1955	14	15
14	ANASHUGAK, Fred	1/1 Eskimo	M	70	August 1955	14	19
15	AVEOGANNA, Joe	1/1 Eskimo	M	68	August 1955	14	21
16	NAGEAK, Steve	1/1 Eskimo	M	47	August 1955	12	32
17	MATOO, Martin	1/1 Eskimo	M	75	August 1955	14	32
18	NAYAKIK, McRidge	1/1 Eskimo	M	67	August 1955	14	28
19	NAGIAK, Jamie	1/1 Eskimo	M	20	August 1955	14	26
20	ANYOOVIK, Franklin	1/1 Eskimo	M	43	August 1955	14	35

TABLE VII (Cont'd)

THYROID UPTAKE OF I^{131} 24 HOURS FOLLOWING THE TRACER DOSE IN WAINWRIGHT ESKIMOS (INITIAL STUDY)

Subj. No.	Name	Race	Sex	Age	Date	Dose131 Micro-curies	Thyroid Uptake in Percent of Tracer Dose 24 hours following dose
21	TAGAROOK, Peter	1/1 Eskimo	M	31	August 1955	14	32
22	PEELUK, Rossman	1/1 Eskimo	M	22	August 1955	12	27
23	PATKOTAK, Paul	1/1 Eskimo	M	63	August 1955	14	35
24	NASHOALIK, Alva	1/1 Eskimo	M	57	August 1955	14	29
25	SEGEVAN, Sheldon, Sr.	1/1 Eskimo	M	50	August 1955	14	42
26	AHMOAGOK, Roy	1/2 Eskimo	M	57	August 1955	50	16
27	NEGOVANNA, Weir	1/2 Eskimo	M	48	August 1955	50	36**
28	AHLALOOK, David	1/1 Eskimo	M	21	August 1955	50	21
29	PANIKPOK, Lindy	1/1 Eskimo	M	23	August 1955	50	45
30	NEGOVANNA, Irving	1/1 Eskimo	M	21	August 1955	50	29**
31	BODFISH, Wayne	3/4 Eskimo	M	22	August 1955	50	32
32	PANIK, David	1/1 Eskimo	M	41	August 1955	50	25
33	DREGGS, Albert	1/1 Eskimo	M	37	August 1955	26	27
34	SEGEVAN, Sheldon, Jr.	1/1 Eskimo	M	20	August 1955	50	34
35	ALMAOGAK, Bennie	3/4 Eskimo	M	21	August 1955	26	20
36	NAYAKIK, Charles	1/1 Eskimo	M	28	August 1955	26	39
37	UNGRIDRAK, Steve	1/1 Eskimo	M	31	August 1955	26	20
38	KAYUTAK, Leo	7/8 Eskimo	M	20	August 1955	26	24
39	BODFISH, Barry	3/4 Eskimo	M	21	August 1955	30	19
40	AHMAOGAK, Florence	3/4 Eskimo	F	26	August 1955	50	20

TABLE VII (Cont'd)

THYROID UPTAKE OF I^{131} 24 HOURS FOLLOWING THE TRACER DOSE IN WAINWRIGHT ESKIMOS (INITIAL STUDY)

Subj. No.	Name	Race	Sex	Age	Date	Dose I^{131} Micro-curies	Thyroid Uptake in Percent of Tracer Dose 24 hours following dose
41	ASOGEAK, Sally	--	F	38	August 1955	50	34
42	BODFISH, Mabel	3/4 Eskimo	F	20	August 1955	50	17
43	NATOMEALOOK, Lena Mae	1/1 Eskimo	F	23	August 1955	50	21
44	KOGAK, Ester Mae	1/2 Eskimo	F	31	August 1955	50	31
45	PATKOTAK, Amy	1/1 Eskimo	F	24	August 1955	50	18
46	TAGAROOK, Bernice	1/1 Eskimo	F	26	August 1955	50	23
47	UNGUDRUK, Emily	1/1 Eskimo	F	24	August 1955	50	15**
MEAN				39		28	27

*Clinically normal, with the exception of frequently complaining of loose stools. No evidence of medication containing iodine.

**48 hours following tracer dose.

NOTE: One 30-year-old Eskimo woman at Wainwright, Susie Segevan, had a markedly enlarged thyroid and showed definite clinical signs of thyrotoxicosis. Her height was 60 inches, weight 104 lbs.; her oral temperature was 99.4° F., pulse rate 120, blood pressure 140/80. Her thyroid uptake of I^{131} was as follows:

Hours following tracer dose	Thyroid Uptake of I^{131} in percent of dose
24	72
48	66
87	58
114	62

TABLE VIII

THYROID UPTAKE OF I^{131} IN POINT LAY ESKIMOS (INITIAL STUDY)

Subj. No.	Name	Race	Sex	Age	Date	Dose I^{131} Micro-curies	Thyroid Uptake in Percent of Tracer Dose: Time in hours following dose 6	24	36	40
48	NEKOK, Warren	1/1 Eskimo	M	33	Aug. 1955	16	--	35	--	--
49	SUSOOK, Dan	1/1 Eskimo	M	50	Aug. 1955	16	16	18	--	27
50	SUSOOK, Robert	1/1 Eskimo	M	16	Aug. 1955	16	16	27	--	30
51	SAMASUOLIK, Simon	1/1 Eskimo	M	90	Aug. 1955	16	--	31	--	29
52	ATHINGOURUK, Leo	1/1 Eskimo	M	42	Aug. 1955	16	--	30	--	34
53	TUKROOK, Patrick	1/1 Eskimo	M	53	Aug. 1955	16	--	31	--	36
54	TOOROK, Nickie	1/1 Eskimo	M	80	Aug. 1955	16	--	34	43	--
55	NEAKOK, Dorcas	1/1 Eskimo	F	36	Aug. 1955	16	--	14	--	--
56	SHAGLOAK, Virginia	1/1 Eskimo	F	33	Aug. 1955	16	--	33	--	--
57	TUURAK, Grace	1/1 Eskimo	F	21	Aug. 1955	16	24	37	--	37
58	AGNASAGGA, Ruth	1/1 Eskimo	F	39	Aug. 1955	16	25	34	--	37
59	NEOTOK, Lucy	1/1 Eskimo	F	30	Aug. 1955	16	--	30	--	28
MEAN				44		16	20	30	--	32

TABLE IX

THYROID UPTAKE OF I^{131} IN ANAKTUVUK PASS ESKIMOS (INITIAL STUDY)

Subj. No.	Name	Race	Sex	Age	Date	Dose I^{131} Micro-curies	Thyroid Uptake in Percent of Tracer Dose — Time in hours following dose: 6	12	24	36	48	72
60	AHGOOK, Jessie	1/1 Eskimo	M	73	Sept. 1955	35						
61	NAPTEGAK, Morry	1/1 Eskimo	M	76	Sept. 1955	35	--	--	42	--	--	--
62	MEKIANA, Rebecca	1/1 Eskimo	F	36	Sept. 1955	37	--	--	47	--	--	--
63	HUGO, Sarah	1/1 Eskimo	F	44	Sept. 1955	37	24	30	36	--	35	35
65	RULLAND, Jane	1/1 Eskimo	F	27	Sept. 1955	37	45	67	69	--	68	67
66	RULLAND, Johnny	1/1 Eskimo	M	27	Sept. 1955	35	55	60	59	--	58	60
67	MORRY, John	1/1 Eskimo	M	44	Sept. 1955	37	--	--	67	--	68	--
68	AHGOOK, Jack	1/1 Eskimo	M	28	Sept. 1955	37	65	60	80	--	76	71
69	AHGOOK, Ben	1/1 Eskimo	M	33	Sept. 1955	37	45	51	54	--	52	55
70	MORRY, Billy	1/1 Eskimo	M	41	Sept. 1955	35	37	47	55	--	52	56
71	AHGOOK, Elizabeth	1/1 Eskimo	F	29	Sept. 1955	37	--	--	57	--	60	--
72	AHGOOK, Bob	1/1 Eskimo	M	26	Sept. 1955	37	41	46	48	--	50	53
73	HUGO, John	1/1 Eskimo	M	34	Sept. 1955	37	51	62	63	--	63	60
74	MORRY, Amos	1/1 Eskimo	M	26	Sept. 1955	37	42	54	58	--	54	51
75	AHGOOK, Rhoda	1/1 Eskimo	F	25	Sept. 1955	37	38	52	52	--	55	56
76	HUGO, Dora	1/1 Eskimo	F	33	Sept. 1955	37	61	82	80	--	77	82
77	MEKIANA, Molly	1/1 Eskimo	F	22	Sept. 1955	37	57	67	70	--	63	68
							71	66	80	--	79	77
MEAN				37		37	49	59	60	--	61	61

TABLE X

THYROID UPTAKE I^{131} IN FORT YUKON INDIANS (INITIAL STUDY)

Subj. No.	Name	Race	Sex	Age	Date	Dose I^{131} Micro-curies	Thyroid Uptake in Percent of Tracer Dose — Time in hours following dose: 6	12	24	36	48	72	96	120	144	168
80	STEPHENS, Gilbert	1/1 Indian	M	25	Oct 1955	50	14	22	25	22	25	26	26	24	22	21
81	GEORGE, Steven	1/1 Indian	M	26	Oct 1955	50	14	19	21	22	25	24	25	20	20	21
82	SAM, Moses	1/1 Indian	M	40	Oct 1955	50	21	31	34	34	39	38	42	33	34	34
83	TRITT, Peter	1/1 Indian	M	24	Oct 1955	50	10	14	16	15	16	16	18	14	15	15
84	JOHN, Isaac	1/1 Indian	M	21	Oct 1955	50	21	26	32	33	35	35	35	32	29	31
85	BAALAM, Randall	1/1 Indian	M	24	Oct 1955	50	12	16	17	16	18	18	20	17	17	16
MEAN				27		50	15	21	24	24	26	26	28	23	23	23

TABLE XI

THYROID UPTAKE OF I^{131} IN ARCTIC VILLAGE INDIANS (INITIAL STUDY)

Subj. No.	Name	Race	Sex	Age	Date	Dose I^{131} Micro-curies	Thyroid Uptake in Percent of Tracer Dose — Time in hours following dose: 6	12	24	36	48
86	TRITT, Ellen	1/1 Indian	F	30	Oct 1955	50	75	--	83	--	--
87	GILBERT, Trimble	1/1 Indian	M	20	Oct 1955	50	--	--	66	--	--
88	GILBERT, James	1/1 Indian	M	45	Oct 1955	38	52	--	61	--	61
89	GILBERT, Maggie	1/1 Indian	F	59	Oct 1955	38	84	--	81	--	61
90	WILLIAMS, Mary	1/1 Indian	F	22	Oct 1955	30	28	--	42	--	--
91	GILBERT, Florence	1/1 Indian	F	17	Oct 1955	30	45	--	67	--	--
92	PETER, Alice	1/1 Indian	F	50	Oct 1955	30	36	--	53	--	--
93	HENRY, Neil	1/1 Indian	M	30	Oct 1955	30	22	--	36	--	--
MEAN				34		37	49	--	61	--	--

TABLE XII

THYROID UPTAKE OF I^{131} IN WHITE CONTROLS (INITIAL STUDY)

Subj. No.	Name	Race	Sex	Age	Date	Dose I^{131} Micro-curies	Thyroid Uptake in Percent of Tracer Dose — Time in hours following dose: 6	8	12	24	36	48	72	96	120	144	168
97	STRASMA, Raymond	White	M	20	Sept 1955	18	14	15	16	25	24	25	21	21	20	--	--
98	BARBER, James	White	M	23	Sept 1955	18	21	21	30	37	37	38	34	32	29	31	32
99	LEVENSTEIN, Irving	White	M	21	Sept 1955	18	17	20	28	34	32	35	34	31	28	--	--
100	FOWLER, Donald	White	M	19	Sept 1955	18	12	15	16	18	22	20	18	18	15	18	20
101	PACE, Edwin	White	M	36	Oct 1955	18	18	20	27	37	36	38	34	39	--	36	39
102	WOODRUFF, James	White	M	21	Oct 1955	18	8	12	15	20	19	19	19	20	20	19	20
103	BEHYMER, Ken	White	M	19	Oct 1955	18	14	13	17	18	18	20	18	21	21	21	21
104	GLISCZINSKI, Raymond	White	M	29	Oct 1955	18	10	13	13	16	19	17	17	17	18	16	16
MEAN				24		18	14	16	20	26	26	27	25	25	22	24	24

normally encountered by soldiers engaged in usual arctic service or by Alaskan Eskimos or Indians in the course of their normal life or activities.

SUMMARY AND CONCLUSION

An assessment has been made of the role of the thyroid in man during the cold exposure usually encountered during normal arctic living or operations and during simulated emergency survival in the cold.

Tracer doses of up to 65 microcuries I^{131} were used to determine the thyroid uptake, urinary and salivary elimination, total plasma and protein-bound I^{131}, using sensitive scintillation counters as part of a complete mobile isotope laboratory which could be transported to remote areas of Arctic Alaska.

The study, furthermore, included careful clinical examination, estimates of dietary iodine intakes, environmental exposure, and analyses of PBI and serum cholesterol.

The subjects included coastal and inland Eskimos, two groups of Athapascan Indians of Fort Yukon and Arctic Village, and white controls including a group of Army soldiers and a group of Air Force technicians. Furthermore, the thyroid activity was assessed in a group of Caucasians before and after a 4-week simulated emergency survival situation. Finally, a more detailed study was made in a group of infantry soldiers and coastal Eskimos to determine blood levels of I^{131} from 6 to 48 hours following the tracer dose.

In 46 cases, the procedure was repeated in the same subjects at different seasons of the year. A total of 200 tracer experiments was made in 19 Whites, 84 Eskimos, and 17 Indians.

When comparing the thyroid function--as judged by thyroid uptakes, urinary elimination and blood levels of I^{131}, and protein-bound iodine--in Whites, coastal Eskimos, and Fort Yukon Indians, it is observed that there appears to be no real difference in thyroid uptake or urinary elimination of I^{131}, in the PBI^{131}, or in the conversion ratio; and that there was no consistent seasonal difference in the PBI or any significant difference between the natives and the Whites.

There was no real evidence of any greater thyroid stimulation in infantrymen engaged in extensive outdoor activities than in airmen engaged in indoor activities during the winter; nor was there any evidence of increased thyroid stimulation in the Whites at the end of a 4-week severe cold exposure.

The inland Eskimos at Anaktuvuk Pass and the mountain Indians at Arctic Village, Alaska, had abnormally high and rapid I^{131} uptakes (up to 85 percent of the tracer dose 24 hours following the dose). They had a very low urinary elimination of I^{131}, reduced salivary I^{131} concentrations, and low plasma and protein-bound I^{131} levels 24 hours following the tracer dose. This was associated with exceedingly low iodine intakes and a high incidence of thyroid enlargements. A significant reduction in the thyroid uptake of I^{131} occurred in the group of inland Eskimos and Arctic Village Indians following daily supplements of 0.6 mg. potassium iodide for 3 months.

These findings are typical of endemic goiter, and it would be reasonable to conclude that the observed deviation from the normal in the iodine metabolism in the inland Eskimos and Arctic Village Indians is a manifestation of endemic goiter and cannot be taken as an indication of the effect of cold exposure on thyroid function.

It is therefore concluded that, on the basis of these data, it appears that the thyroid does not play any significant role in human acclimatization to the arctic environment when the cold stress is no greater than what is normally encountered by soldiers engaged in usual arctic service or by Alaskan Eskimos or Indians in the course of their normal life or activities.

ACKNOWLEDGEMENTS

Technical assistance by Mr. Robert W. Elsner, Mrs. Arna Bang, and Miss Delilah Metz in the isotope studies and by Dr. Horace F. Drury in the iodine determinations is gratefully acknowledged.

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