CH PROGRAMME NO. 54
EXPOSURE TESTING (STUDY OF MATERIAL DETERIORATION)

sponsored by
ADVANCED RESEARCH PROJECTS AGENCY (ARPA), U.S. DEPARTMENT OF DEFENSE

conducted by
APPLIED SCIENTIFIC RESEARCH CORPORATION OF THAILAND
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PRESERVED FOOD SERIES

REPORT NO. 6
COMBAT AND SURVIVAL RATIONS

BY
KAEW NUALCHAWEE
WILLIAM G. PREWETT
ENVIRONMENTAL AND ECOLOGICAL RESEARCH INSTITUTE

ASRCT, BANGKOK 1974
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COMBAT AND SURVIVAL RATIONS

By Kaew Nualchawee* and William G. Prewett*

SUMMARY

The following is a report on exposure tests made on samples of preserved foods at the second withdrawal (after a period of 6 months exposure). The report begins with a statement of purpose which is contained in the introduction. This is followed by a description of the nature of the samples, the conditions of exposure, and the tests applied to the exposed samples which description is, in turn, followed by tables of results and of meteorological records made at the exposure sites during the exposure period. The tables are followed by a discussion of the results presented in them.

It is stated in the conclusion, which follows the discussion of results, that the packaging of the samples has already been demonstrated to be far from perfect. Most samples appear to be acquiring moisture which will ultimately lead to their decay, some have been attacked by insects and some packets are visibly perforated. However, at the time of this withdrawal, microorganism counts were still low.

INTRODUCTION

It has been requested by the Military Research and Development Center that the Exposure Testing Project of ASRCT should test the durability of a variety of preserved foods stored under "field" conditions in Thailand, with a view to assessing their usefulness as field rations. Samples, supplied by the Preserved Food Organisation of Thailand, are being stored for a maximum period of two years at the Sakaerat Experiment Station in rural N.E. Thailand. A total of eight withdrawals will be made at three monthly intervals. This report concerns samples of the second withdrawal which were stored at Sakaerat for six months and returned to Bangkok for examination and testing on 17 January 1972.

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*Environmental and Ecological Research Institute, ASRCT.

MATERIALS AND METHODS

Materials

The foodstuffs undergoing test, with which this report is concerned, are as follows:

Foodstuff	Labelling code
1. Dehydrated, cooked rice	5-2-1
2. Banana jam	5-2-4
3. Survival ration, No. 1, in bar type	5-3-1
4. Survival ration, No. 2, in bar type	5-3-2
5. Survival ration, No. 2, in powder type	5-3-3
6. Survival ration, No. 3, in bar type	5-3-4
7. Survival ration, No. 3, in powder type	5-3-5
8. Survival ration, No. 4, in bar type	5-3-6
9. Survival ration, No. 4, in powder type	5-3-7

Conditions of exposure

Two weatherproof, wooden depot huts have been built at Sakaerat Experiment Station for testing samples under conditions of storage similar to those employed by the Armed Forces. One of the depots has been built in the jungle with as little disturbance to the surroundings as possible and the other has been built in a jungle clearing. Each stands clear of the ground on four legs which have been treated to hinder the ingress of termites and other vermin and also to hinder decay of the legs themselves. The depots are ventilated through wire mesh "windows" immediately below the eaves. About 200 metres from the depots is an air-conditioned building used for storage of control samples.

Weighed test samples were placed on shelves in the depots and control samples in the air-conditioned building on 17 July 1971. They were all contained in cardboard boxes. The samples referred to in this report were withdrawn on 17 January 1972.

Identification

The samples are labelled with a code consisting of a succession of figures and letters occupying eleven positions. Reading from the left, these are as follows:

* Position 1. Arabic figure denoting test material ("5" is for "preserved food").

* Position 2. Dash.

* Position 3. Arabic figure denoting the type of preserved food, thus:

1 canned food (no samples covered in this report)
2 combat rations
3 survival rations.

* Position 4. Dash.

* Position 5. Arabic figure denoting exact nature of food sample.

Position 6. Dash.

Position 7. Roman figure indicating the location of the sample during the exposure period, thus:

I -in the depot at the cleared site
II-in the depot at the jungle site
No figure-in the air-conditioned building.

Position 8. Upper case letter indicating the storage shelf

U for upper
L for lower

Position 9. For all samples covered in this report, a lower case "a" indicating that the samples were enclosed in cardboard boxes during the exposure period.

Position 10. For all samples covered in this report, an upper case "B" indicating that they were withdrawn after 6 months exposure (second withdrawal).

Position 11. Replicate number for distinguishing otherwise identical samples.

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*See page 3, "materials" for details of use of positions 1 to 5

Tests made on exposed samples

Each sample was weighed before and after its period of exposure and examined for visible changes. The total populations of mold and aerobic bacteria were counted and tests were made for the presence of anaerobic and coliform bacteria. All these tests had also been performed on similar samples before the beginning of the exposure period.

Meteorology

Concurrently with the exposure of test samples, meteorological observations are being made at the exposure sites, those reported below covering the period from 17 October 1971 until 17 January 1972, this being the interval between the first and second withdrawals. Meteorological observations for the period from 17 July 1971 until 17 October 1971 may be seen in "Report No. 5" made at the first withdrawal.

The following observations are reported in Table 3:

1. Daily maximum and minimum temperature and relative humidity inside the depots and outside at the jungle and cleared sites. Temperature and humidity were recorded by Lambrecht "Hygrothermographs" and are reported as degree Fahrenheit and as percentage respectively.

2. Daily total rainfall as recorded by Belfort Recording Rain Gauges at the jungle and cleared sites. Rainfall is reported in millimetres.

3. Daily duration of sunshine as recorded at the cleared site by a Campbell-Stokes Sunshine Recorder. Sunshine is reported in hours.

TABLE 1. VISUAL OBSERVATIONS AND WEIGHT CHANGES

Code number	Description	Type of packaging	Original weight (g)	Weight change (g)	Observations
5-2-1-aB1	Dehydrated, cooked rice	paper bag	206.78	+ 1.92	
5-2-1-aB2	"	"	217.02	+ 2.98	
5-2-1-aB3	"	"	229.26	+ 3.24	
5-2-1-aB4	"	"	224.20	+ 2.93	
5-2-1-I-UaB1	Dehydrated, cooked rice	paper bag	209.66	+ 2.29	
5-2-1-I-UaB2	"	"	226.65	+ 2.79	
5-2-1-I-UaB3	"	"	209.76	+ 1.99	
5-2-1-I-UaB4	"	"	213.13	+ 1.89	
5-2-1-I-LaB1	Dehydrated, cooked rice	paper bag	218.03	+ 3.43	
5-2-1-I-LaB2	"	"	210.25	+ 3.10	
5-2-1-I-LaB3	"	"	199.40	+ 2.41	
5-2-1-I-LaB4	"	"	221.49	+ 5.57	
5-2-1-II-UaB1	Dehydrated, cooked rice	paper bag	216.83	+ 6.97	
5-2-1-II-UaB2	"	"	219.56	+ 4.55	
5-2-1-II-UaB3	"	"	223.81	+ 4.12	
5-2-1-II-UaB4	"	"	221.30	+ 5.33	
5-2-1-II-LaB1	Dehydrated, cooked rice	paper bag	243.24	+ 6.38	
5-2-1-II-LaB2	"	"	228.59	+ 4.16	
5-2-1-II-LaB3	"	"	243.90	+ 6.00	
5-2-1-II-LaB4	"	"	221.70	+ 4.40	
5-2-4-aB1	Banana jam (dessert)	sealed plastic bag	30.61	+ 0.49	
5-2-4-aB2	"	"	25.40	+ 0.38	
5-2-4-aB3	"	"	30.83	+ 0.34	
5-2-4-aB4	"	"	35.43	+ 0.30	
5-2-4-I-UaB1	Banana jam (dessert)	sealed plastic bag	32.83	+ 0.46	
5-2-4-I-UaB2	"	"	27.16	+ 0.61	
5-2-4-I-UaB3	"	"	28.30	+ 0.48	
5-2-4-I-UaB4	"	"	24.27	+ 0.53	
5-2-4-I-LaB1	Banana jam (dessert)	sealed plastic bag	25.01	+ 1.31	
5-2-4-I-LaB2	"	"	24.70	+ 1.00	
5-2-4-I-LaB3	"	"	29.63	+ 0.87	
5-2-4-I-LaB4	"	"	35.14	+ 0.44	
5-2-4-II-UaB1	Banana jam (dessert)	sealed plastic bag	25.29	+ 1.46	
5-2-4-II-UaB2	"	"	25.05	+ 0.50	
5-2-4-II-UaB3	"	"	35.14	+ 1.21	
5-2-4-II-UaB4	"	"	31.40	+ 0.60	
5-2-4-II-LaB1	Banana jam (dessert)	sealed plastic bag	23.70	+ 0.88	
5-2-4-II-LaB2	"	"	30.19	+ 0.86	
5-2-4-II-LaB3	"	"	28.41	+ 0.67	
5-2-4-II-LaB4	"	"	30.51	+ 1.03	

TABLE 1. continued.

Code number	Description	Type of packaging	Original weight (g)	Weight change (g)	Observations
5-3-1-aB1	Survival ration, No.1 (bar)	green aluminium foil	59.27	+ 0.75	
5-3-1-aB2	"	"	58.40	+ 0.66	
5-3-1-aB3	"	"	60.66	+ 1.14	
5-3-1-aB4	"	"	55.91	+ 0.64	ant attacked
5-3-1-I-UaB1	Survival ration, No.1 (bar)	green aluminium foil	57.72	+ 1.76	
5-3-1-I-UaB2	"	"	65.83	+ 1.91	
5-3-1-I-UaB3	"	"	62.85	+ 1.49	
5-3-1-I-UaB4	"	"	66.31	+ 1.19	ant attacked
5-3-1-I-LaB1	Survival ration, No.1 (bar)	green aluminium foil	63.42	+ 1.33	
5-3-1-I-LaB2	"	"	61.57	+ 1.38	
5-3-1-I-LaB3	"	"	71.92	+ 1.78	
5-3-1-I-LaB4	"	"	61.55	+ 1.47	
5-3-1-II-UaB1	Survival ration, No.1 (bar)	green aluminium foil	60.01	+ 1.89	
5-3-1-II-UaB2	"	"	59.20	+ 1.90	
5-3-1-II-UaB3	"	"	61.62	+ 1.49	
5-3-1-II-UaB4	"	"	62.80	+ 0.82	
5-3-1-II-LaB1	Survival ration, No.1 (bar)	green aluminium foil	60.30	+ 1.88	
5-3-1-II-LaB2	"	"	65.80	+ 2.23	
5-3-1-II-LaB3	"	"	63.35	+ 1.70	
5-3-1-II-LaB4	"	"	56.60	+ 1.55	
5-3-2-aB1	Survival ration, No.2 (bar)	aluminium foil	64.36	+ 0.19	
5-3-2-aB2	"	"	60.34	+ 0.51	
5-3-2-aB3	"	"	60.92	+ 0.20	
5-3-2-aB4	"	"	66.75	+ 0.73	
5-3-2-I-UaB1	Survival ration, No.2 (bar)	aluminium foil	57.80	+ 0.35	
5-3-2-I-UaB2	"	"	56.90	+ 0.12	ant attacked
5-3-2-I-UaB3	"	"	58.48	+ 0.44	
5-3-2-I-UaB4	"	"	64.91	+ 0.89	ant attacked
5-3-2-I-LaB1	Survival ration, No.2 (bar)	aluminium foil	58.70	+ 0.81	
5-3-2-I-LaB2	"	"	61.18	+ 0.95	ant attacked
5-3-2-I-LaB3	"	"	56.42	+ 0.18	
5-3-2-I-LaB4	"	"	60.79	+ 0.03	
5-3-2-II-UaB1	Survival ration, No.2 (bar)	aluminium foil	59.14	+ 1.50	
5-3-2-II-UaB2	"	"	63.40	0.0	
5-3-2-II-UaB3	"	"	66.61	- 0.01	
5-3-2-II-UaB4	"	"	59.60	+ 0.44	
5-3-2-II-LaB1	Survival ration, No.2 (bar)	aluminium foil	66.55	+ 0.45	
5-3-2-II-LaB2	"	"	57.76	+ 0.32	
5-3-2-II-LaB3	"	"	58.71	+ 0.75	ant attacked
5-3-2-II-LaB4	"	"	64.43	+ 0.32	

TABLE 1. continued.

Code number	Description	Type of packaging	Original weight (g)	Weight change (g)	Observations
5-3-3-aB1	Survival ration, No.2 (powdered)	aluminium foil	55.65	+ 0.25	
5-3-3-aB2	"	"	58.70	+ 0.22	ant attacked
5-3-3-aB3	"	"	58.30	- 0.01	
5-3-3-aB4	"	"	54.59	+ 0.16	
5-3-3-I-UaB1	Survival ration, No.2 (powdered)	aluminium foil	64.42	- 0.01	
5-3-3-I-UaB2	"	"	55.60	+ 0.12	
5-3-3-I-UaB3	"	"	52.95	+ 0.60	
5-3-3-I-UaB4	"	"	65.15	+ 0.13	
5-3-3-I-LaB1	Survival ration, No.2 (powdered)	aluminium foil	57.72	+ 0.85	ant attacked
5-3-3-I-LaB2	"	"	60.75	+ 0.09	
5-3-3-I-LaB3	"	"	55.98	+ 0.82	
5-3-3-I-LaB4	"	"	57.80	+ 0.30	
5-3-3-II-UaB1	Survival ration, No.2 (powdered)	aluminium foil	58.28	+ 1.09	
5-3-3-II-UaB2	"	"	58.70	+ 0.91	
5-3-3-II-UaB3	"	"	56.30	+ 0.04	
5-3-3-II-UaB4	"	"	59.87	+ 3.88	
5-3-3-II-LaB1	Survival ration, No.2 (powdered)	aluminium foil	57.85	+ 0.80	
5-3-3-II-LaB2	"	"	56.71	0.0	
5-3-3-II-LaB3	"	"	55.10	+ 0.39	
5-3-3-II-LaB4	"	"	55.30	+ 0.25	
5-3-4-aB1	Survival ration, No.3 (bar)	aluminium foil	57.69	+ 0.39	ant attacked
5-3-4-aB2	"	"	53.30	+ 0.32	
5-3-4-aB3	"	"	55.00	+ 0.31	
5-3-4-aB4	"	"	56.37	- 0.55	ant attacked
5-3-4-I-UaB1	Survival ration, No.3 (bar)	aluminium foil	53.63	+ 0.07	
5-3-4-I-UaB2	"	"	55.79	+ 1.02	
5-3-4-I-UaB3	"	"	55.44	+ 0.22	
5-3-4-I-UaB4	"	"	59.49	+ 0.59	ant attacked
5-3-4-I-LaB1	Survival ration, No.3 (bar)	aluminium foil	56.95	- 0.01	
5-3-4-I-LaB2	"	"	53.71	+ 0.18	
5-3-4-I-LaB3	"	"	55.97	+ 4.22	
5-3-4-I-LaB4	"	"	61.17	+ 1.13	
5-3-4-II-UaB1	Survival ration, No.3 (bar)	aluminium foil	59.95	+ 0.09	
5-3-4-II-UaB2	"	"	57.67	+ 0.24	
5-3-4-II-UaB3	"	"	57.69	+ 0.20	
5-3-4-II-UaB4	"	"	60.68	+ 0.41	
5-3-4-II-LaB1	Survival ration No.3 (bar)	aluminium foil	57.30	+ 0.30	
5-3-4-II-LaB2	"	"	58.33	+ 0.67	
5-3-4-II-LaB3	"	"	70.25	+ 0.70	
5-3-4-II-LaB4	"	"	57.48	+ 0.18	

TABLE 1. continued.

Code number	Description	Type of packaging	Original weight (g)	Weight change (g)	Observations
5-3-5-aB1	Survival ration, No.3 (powdered)	aluminium foil	57.58	+ 0.20	
5-3-5-aB2	"	"	58.20	+ 0.02	
5-3-5-aB3	"	"	56.75	- 0.03	
5-3-5-aB4	"	"	58.43	- 0.69	
5-3-5-I-UaB1	Survival ration, No.3 (powdered)	aluminium foil	62.78	- 0.07	
5-3-5-I-UaB2	"	"	61.07	+ 0.23	
5-3-5-I-UaB3	"	"	56.39	+ 0.01	
5-3-5-I-UaB4	"	"	58.37	+ 0.48	
5-3-5-I-LaB1	Survival ration, No.3 (powdered)	aluminium foil	56.84	+ 0.04	
5-3-5-I-LaB2	"	"	61.46	+ 0.04	
5-3-5-I-LaB3	"	"	64.51	+ 0.17	
5-3-5-I-LaB4	"	"	64.82	+ 0.03	
5-3-5-II-UaB1	Survival ration, No.3 (powdered)	aluminium foil	60.59	+ 0.22	
5-3-5-II-UaB2	"	"	60.81	+ 0.87	
5-3-5-II-UaB3	"	"	60.43	+ 0.07	ant attacked
5-3-5-II-UaB4	"	"	63.73	- 3.15	ant attacked
5-3-5-II-LaB1	Survival ration, No.3 (powdered)	aluminium foil	55.96	+ 0.06	
5-3-5-II-LaB2	"	"	56.32	+ 0.32	
5-3-5-II-LaB3	"	"	57.46	+ 0.04	
5-3-5-II-LaB4	"	"	60.25	+ 0.04	
5-3-6-aB1	Survival ration, No.4 (bar)	green aluminium foil	62.96	+ 1.22	
5-3-6-aB2	"	"	62.24	+ 0.51	
5-3-6-aB3	"	"	60.49	+ 0.26	ant attacked
5-3-6-aB4	"	"	62.20	+ 0.22	
5-3-6-I-UaB1	Survival ration, No.4 (bar)	green aluminium foil	62.51	+ 1.41	
5-3-6-I-UaB2	"	"	61.73	+ 1.45	big hole
5-3-6-I-UaB3	"	"	70.09	+ 0.41	bitten by
5-3-6-I-UaB4	"	"	60.58	+ 1.27	insects or mice
5-3-6-I-LaB1	Survival ration, No.4 (bar)	green aluminium foil	62.84	+ 2.02	
5-3-6-I-LaB2	"	"	58.09	+ 1.19	
5-3-6-I-LaB3	"	"	56.99	+ 1.69	
5-3-6-I-LaB4	"	"	61.00	+ 1.12	
5-3-6-II-UaB1	Survival ration, No.4 (bar)	green aluminium foil	62.44	+ 0.08	
5-3-6-II-UaB2	"	"	62.35	+ 1.95	
5-3-6-II-UaB3	"	"	59.71	+ 1.10	
5-3-6-II-UaB4	"	"	55.58	+ 1.61	
5-3-6-II-LaB1	Survival ration, No.4 (bar)	green aluminium foil	62.92	+ 2.13	
5-3-6-II-LaB2	"	"	62.90	+ 1.41	
5-3-6-II-LaB3	"	"	62.90	+ 1.40	
5-3-6-II-LaB4	"	"	61.39	+ 2.61	

TABLE 1. continued.

Code number	Description	Type of packaging	Original weight (g)	Weight change (g)	Observations
5-3-7-aB1	Survival ration, No.4 (powdered)	green aluminium foil	61.35	+ 2.16	
5-3-7-aB2	"	"	63.15	+ 1.91	
5-3-7-aB3	"	"	58.96	+ 1.30	
5-3-7-aB4	"	"	69.16	+ 1.66	
5-3-7-I-UaB1	Survival ration, No.4 (powdered)	green aluminium foil	58.00	+ 0.93	
5-3-7-I-UaB2	"	"	54.16	+ 0.52	
5-3-7-I-UaB3	"	"	55.17	+ 0.12	
5-3-7-I-UaB4	"	"	59.41	+ 0.02	
5-3-7-I-LaB1	Survival ration, No.4 (powdered)	green aluminium foil	56.28	+ 0.87	
5-3-7-I-LaB2	"	"	57.41	+ 0.40	
5-3-7-I-LaB3	"	"	59.58	+ 1.10	
5-3-7-I-LaB4	"	"	58.68	+ 0.55	
5-3-7-II-UaB1	Survival ration, No.4 (powdered)	green aluminium foil	60.79	+ 1.49	
5-3-7-II-UaB2	"	"	63.91	+ 2.50	
5-3-7-II-UaB3	"	"	61.10	+ 2.57	
5-3-7-II-UaB4	"	"	59.31	+ 1.38	
5-3-7-II-LaB1	Survival ration, No.4 (powdered)	green aluminium foil	64.70	+ 3.90	
5-3-7-II-LaB2	"	"	65.71	+ 3.29	
5-3-7-II-LaB3	"	"	62.75	+ 2.60	
5-3-7-II-LaB4	"	"	64.18	+ 2.22	

TABLE 2. MICROBIOLOGICAL OBSERVATIONS

Code number	Description	Aerobic count (colonies/g)	Mold count (colonies/g)	Anaerobic test	Coliform test
5-2-1-aB1	Dehydrated, cooked rice	10	-	-	-
5-2-1-aB2	"	100	-	-	-
5-2-1-aB3	"	-	-	-	-
5-2-1-aB4	"	50	-	-	-
5-2-1-I-UaB1	Dehydrated, cooked rice	-	60	-	-
5-2-1-I-UaB2	"	-	-	-	-
5-2-1-I-UaB3	"	100	30	-	-
5-2-1-I-UaB4	"	-	-	-	-
5-2-1-I-LaB1	Dehydrated, cooked rice	-	10	-	-
5-2-1-I-LaB2	"	50	-	-	-
5-2-1-I-LaB3	"	-	30	-	-
5-2-1-I-LaB4	"	-	100	-	-
5-2-1-II-UaB1	Dehydrated, cooked rice	80	-	-	-
5-2-1-II-UaB2	"	-	100	-	-
5-2-1-II-UaB3	"	-	100	-	-
5-2-1-II-UaB4	"	-	200	-	-
5-2-1-II-LaB1	Dehydrated, cooked rice	-	-	-	-
5-2-1-II-LaB2	"	30	-	-	-
5-2-1-II-LaB3	"	400	-	-	-
5-2-1-II-LaB4	"	100	10	-	-
Date of test 10 May 1972.					
5-2-4-aB1	Banana jam	150	-	-	-
5-2-4-aB2	"	190	60	-	-
5-2-4-aB3	"	90	10	-	-
5-2-4-aB4	"	90	20	-	-
5-2-4-I-UaB1	Banana jam	-	70	-	-
5-2-4-I-UaB2	"	10	10	-	-
5-2-4-I-UaB3	"	-	20	-	-
5-2-4-I-UaB4	"	50	30	-	-
5-2-4-I-LaB1	Banana jam	20	20	-	-
5-2-4-I-LaB2	"	10	50	-	-
5-2-4-I-LaB3	"	10	90	-	-
5-2-4-I-LaB4	"	150	10	-	-
5-2-4-II-UaB1	Banana jam	50	-	-	-
5-2-4-II-UaB2	"	70	-	-	-
5-2-4-II-UaB3	"	80	-	-	-
5-2-4-II-UaB4	"	100	-	-	-
5-2-4-II-LaB1	Banana jam	20	-	-	-
5-2-4-II-LaB2	"	190	-	-	-
5-2-4-II-LaB3	"	-	-	-	-
5-2-4-II-LaB4	"	80	-	-	-
Date of test 12 May 1972.					

Note. - indicates a negative test result; i.e. microorganisms not detectable.

TABLE 2. continued.

Code number	Description	Aerobic count (colonies/g)	Mold count (colonies/g)	Anaerobic test	Coliform test
5-3-1-aB1	Survival ration, No.1 (bar)	100	1000	-	-
5-3-1-aB2	"	1500	-	-	-
5-3-1-aB3	"	1000	-	-	-
5-3-1-aB4	"	2400	-	-	-
5-3-1-I-UaB1	Survival ration, No.1 (bar)	1500	-	-	-
5-3-1-I-UaB2	"	1900	-	-	-
5-3-1-I-UaB3	"	200	-	-	-
5-3-1-I-UaB4	"	3400	-	-	-
5-3-1-I-LaB1	Survival ration, No.1 (bar)	600	-	-	-
5-3-1-I-LaB2	"	1900	-	-	-
5-3-1-I-LaB3	"	400	-	-	-
5-3-1-I-LaB4	"	1000	-	-	-
5-3-1-II-UaB1	Survival ration, No.1 (bar)	600	-	-	-
5-3-1-II-UaB2	"	400	100	-	-
5-3-1-II-UaB3	"	600	-	-	-
5-3-1-II-UaB4	"	600	-	-	-
5-3-1-II-LaB1	Survival ration, No.1 (bar)	800	-	-	-
5-3-1-II-LaB2	"	500	400	-	-
5-3-1-II-LaB3	"	1000	-	-	-
5-3-1-II-LaB4	"	1000	-	-	-
Date of test 29 May 1972.					
5-3-2-aB1	Survival ration, No.2 (bar)	400	-	-	-
5-3-2-aB2	"	500	200	+	-
5-3-2-aB3	"	400	-	-	-
5-3-2-aB4	"	400	-	-	-
5-3-2-I-UaB1	Survival ration, No.2 (bar)	200	-	-	-
5-3-2-I-UaB2	"	1100	-	-	-
5-3-2-I-UaB3	"	700	-	-	-
5-3-2-I-UaB4	"	1200	100	-	-
5-3-2-I-LaB1	Survival ration, No.2 (bar)	100	-	-	-
5-3-2-I-LaB2	"	800	-	-	-
5-3-2-I-LaB3	"	600	-	-	-
5-3-2-I-LaB4	"	200	-	-	-
5-3-2-II-UaB1	Survival ration, No.2 (bar)	600	-	-	-
5-3-2-II-UaB2	"	600	-	-	-
5-3-2-II-UaB3	"	600	-	-	-
5-3-2-II-UaB4	"	-	-	-	-
5-3-2-II-LaB1	Survival ration, No.2 (bar)	300	-	-	-
5-3-2-II-LaB2	"	100	-	-	-
5-3-2-II-LaB3	"	300	-	-	-
5-3-2-II-LaB4	"	1600	-	-	-
Date of test 25 May 1972.					

Note. - indicates a negative test result; i.e. microorganisms not detectable.

+ indicates a positive test result; i.e. anaerobic or coliform bacteria detected.

TABLE 2. continued.

Code number	Description	Aerobic count (colonies/g)	Mold count (colonies/g)	Anaerobic test	Coliform test
5-3-3-aB1	Survival ration, No.2 (powdered)	200	500	+	-
5-3-3-aB2	"	1200	-	-	-
5-3-3-aB3	"	300	-	-	-
5-3-3-aB4	"	900	100	-	-
5-3-3-I-UaB1	Survival ration, No.2 (powdered)	100	-	-	-
5-3-3-I-UaB2	"	-	-	-	-
5-3-3-I-UaB3	"	900	-	-	-
5-3-3-I-UaB4	"	400	-	-	-
5-3-3-I-LaB1	Survival ration, No.2 (powdered)	1300	-	-	-
5-3-3-I-LaB2	"	700	400	-	-
5-3-3-I-LaB3	"	600	100	-	-
5-3-3-I-LaB4	"	-	500	-	-
5-3-3-II-UaB1	Survival ration, No.2 (powdered)	300	-	-	-
5-3-3-II-UaB2	"	100	100	-	-
5-3-3-II-UaB3	"	600	-	-	-
5-3-3-II-UaB4	"	700	500	-	-
5-3-3-II-LaB1	Survival ration, No.2 (powdered)	200	1000	-	-
5-3-3-II-LaB2	"	1200	-	-	-
5-3-3-II-LaB3	"	700	500	-	-
5-3-3-II-LaB4	"	700	-	-	-
Date of test 28 April 1972.					
5-3-4-aB1	Survival ration, No.3 (bar)	1300	-	-	-
5-3-4-aB2	"	200	-	-	-
5-3-4-aB3	"	700	-	+	-
5-3-4-aB4	"	200	600	-	-
5-3-4-I-UaB1	Survival ration, No.3 (bar)	1100	100	-	-
5-3-4-I-UaB2	"	500	100	-	-
5-3-4-I-UaB3	"	700	-	-	-
5-3-4-I-UaB4	"	1200	-	-	-
5-3-4-I-LaB1	Survival ration, No.3 (bar)	1300	-	-	-
5-3-4-I-LaB2	"	200	100	-	-
5-3-4-I-LaB3	"	200	-	+	-
5-3-4-I-LaB4	"	200	-	-	-
5-3-4-II-UaB1	Survival ration, No.3 (bar)	100	-	-	-
5-3-4-II-UaB2	"	-	-	-	-
5-3-4-II-UaB3	"	300	-	-	-
5-3-4-II-UaB4	"	100	500	-	-
5-3-4-II-LaB1	Survival ration, No.3 (bar)	300	-	-	-
5-3-4-II-LaB2	"	-	-	+	-
5-3-4-II-LaB3	"	700	100	-	-
5-3-4-II-LaB4	"	-	-	-	-
Date of test 22 May 1972.					

Note. - indicates a negative test result; i.e. microorganisms not detectable.
+ indicates a positive test result; i.e. anaerobic or coliform bacteria detected.

TABLE 2. continued.

Code number	Description	Aerobic count (colonies/g)	Mold count (colonies/g)	Anaerobic test	Coliform test
5-3-5-aB1	Survival ration, No.3 (powdered)	100	100	+	-
5-3-5-aB2	"	300	1600	+	-
5-3-5-aB3	"	700	600	-	-
5-3-5-aB4	"	400	600	-	-
5-3-5-I-UaB1	Survival ration, No.3 (powdered)	-	600	-	-
5-3-5-I-UaB2	"	100	200	-	-
5-3-5-I-UaB3	"	700	600	+	-
5-3-5-I-UaB4	"	-	1100	-	-
5-3-5-I-LaB1	Survival ration, No.3 (powdered)	100	1600	+	-
5-3-5-I-LaB2	"	200	1800	+	-
5-3-5-I-LaB3	"	400	1200	+	-
5-3-5-I-LaB4	"	700	1500	+	-
5-3-5-II-UaB1	Survival ration, No.3 (powdered)	500	100	-	-
5-3-5-II-UaB2	"	1500	600	+	-
5-3-5-II-UaB3	"	1100	100	+	-
5-3-5-II-UaB4	"	1700	1000	+	-
5-3-5-II-LaB1	Survival ration, No.3 (powdered)	400	600	+	-
5-3-5-II-LaB2	"	400	100	+	-
5-3-5-II-LaB3	"	200	-	+	-
5-3-5-II-LaB4	"	300	-	+	-
Date of test 18 April 1972.					
5-3-6-aB1	Survival ration, No.4 (bar)	-	-	-	-
5-3-6-aB2	"	100	-	-	-
5-3-6-aB3	"	2900	500	-	-
5-3-6-aB4	"	-	100	-	-
5-3-6-I-UaB1	Survival ration, No.4 (bar)	500	-	-	-
5-3-6-I-UaB2	"	100	500	-	-
5-3-6-I-UaB3	"	800	500	-	-
5-3-6-I-UaB4	"	100	-	-	-
5-3-6-I-LaB1	Survival ration, No.4 (bar)	100	more than 300,000	-	-
5-3-6-I-LaB2	"	600	-	-	-
5-3-6-I-LaB3	"	-	-	-	-
5-3-6-I-LaB4	"	-	200	-	-
5-3-6-II-UaB1	Survival ration, No.4 (bar)	600	-	-	-
5-3-6-II-UaB2	"	-	600	-	-
5-3-6-II-UaB3	"	-	-	-	-
5-3-6-II-UaB4	"	-	-	-	-
5-3-6-II-LaB1	Survival ration, No.4 (bar)	-	-	-	-
5-3-6-II-LaB2	"	100	-	-	-
5-3-6-II-LaB3	"	100	-	-	-
5-3-6-II-LaB4	"	100	-	+	-
Date of test 6 June 1972.					

Note. - indicates a negative test result; i.e. microorganisms not detectable.

+ indicates a positive test result; i.e. anaerobic or coliform bacteria detected.

TABLE 2. continued.

Code number	Description	Aerobic count (colonies/g)	Mold count (colonies/g)	Anaerobic test	Coliform test
5-3-7-aB1	Survival ration, No.4 (powdered)	-	-	+	-
5-3-7-aB2	"	-	-	-	-
5-3-7-aB3	"	-	-	-	-
5-3-7-aB4	"	200	-	-	-
5-3-7-I-UaB1	Survival ration, No.4 (powdered)	100	-	-	-
5-3-7-I-UaB2	"	100	-	+	-
5-3-7-I-UaB3	"	-	200	+	-
5-3-7-I-UaB4	"	600	-	-	-
5-3-7-I-LaB1	Survival ration, No.4 (powdered)	100	-	-	-
5-3-7-I-LaB2	"	100	-	-	-
5-3-7-I-LaB3	"	-	-	-	-
5-3-7-I-LaB4	"	-	-	+	-
5-3-7-II-UaB1	Survival ration, No.4 (powdered)	-	400	-	-
5-3-7-II-UaB2	"	-	-	-	-
5-3-7-II-UaB3	"	-	-	-	-
5-3-7-II-UaB4	"	-	-	-	-
5-3-7-II-LaB1	Survival ration, No.4 (powdered)	-	-	-	-
5-3-7-II-LaB2	"	-	-	-	-
5-3-7-II-LaB3	"	-	-	-	-
5-3-7-II-LaB4	"	-	-	-	-

Date of test 27 April 1972.

Note. - indicates a negative test result; i.e. microorganisms not detectable.

+ indicates a positive test result; i.e. anaerobic or coliform bacteria detected.

TABLE 3. METEOROLOGICAL DATA

Month: 1st half of October 1971.

Day of the Month	Cleared site										Jungle site									Day of the Month
	Outdoor						In depot				In depot				Outdoor					
	Temperature		Humidity		Rain-	Sun-	Temperature		Humidity		Temperature		Humidity		Temperature		Humidity		Rain-	
	Max.	Min.	Max.	Min.	fall	shine	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	fall	
1	79.0	67.8	100	52	0.0	4.4	83.3	73.0	96	69	79.2	73.4	93	80	78.6	71.8	100	88	0.0	1
2	79.7	68.0	100	46	0.0	4.4	84.2	73.2	97	64	79.3	73.4	95	74	79.2	72.5	100	78	0.0	2
3	79.7	67.6	100	45	0.0	3.5	84.2	72.3	95	66	79.0	73.0	95	78	79.2	71.8	100	78	0.0	3
4	78.8	67.6	100	43	0.0	7.0	82.8	73.0	100	63	80.4	73.2	99	69	79.2	71.8	100	74	0.0	4
5	79.7	66.9	100	48	0.0	9.0	84.4	73.0	98	67	81.1	73.0	97	73	80.4	71.4	100	77	0.0	5
6	76.5	66.2	100	62	17.8	4.9	81.5	71.6	98	74	76.1	72.7	99	93	75.2	70.7	100	100	7.6	6
7	76.3	64.8	100	63	73.6	2.9	82.4	69.8	100	75	76.5	70.7	100	93	76.6	69.4	100	100	58.3	7
8	72.5	64.4	100	75	trace	1.4	77.2	69.8	100	84	73.0	69.8	100	97	72.7	68.7	100	100	trace	8
9	80.6	63.9	100	43	0.0	6.2	84.2	68.0	100	63	77.5	68.5	99	79	78.4	68.0	100	84	0.0	9
10	87.5	63.0	100	92	66.8	0.0	73.4	69.6	99	95	70.2	68.5	99	97	70.0	68.0	100	100	46.0	10
11	67.1	64.0	100	100	0.5	0.0	81.2	69.4	100	98	70.0	68.4	100	100	69.6	67.8	100	100	1.0	11
12	73.6	62.6	99	33	5.6	4.3	77.2	67.8	98	58	72.5	66.6	99	66	73.0	66.0	100	62	2.3	12
13	73.4	62.6	91	28	0.0	9.5	78.1	68.0	89	50	73.8	67.8	93	55	74.3	66.6	100	42	0.0	13
14	70.0	59.0	91	45	0.0	7.3	75.2	64.8	89	64	71.8	65.1	87	69	71.6	64.0	100	68	0.0	14
15	71.6	58.8	94	47	0.0	10.0	77.0	64.4	85	65	73.6	64.4	88	70	73.4	62.8	100	75	0.0	15
16	72.5	57.2	100	38	0.0	9.9	77.0	62.6	95	61	73.6	63.9	94	67	73.2	61.2	100	66	0.0	16
Totals	This page				164.3	84.7													115.2	
	Brought forward				-	-													-	
	For the month				-	-													-	
	Monthly rain days				-	-													-	

N.B. Temperature in ^{o}F; humidity in per cent; rainfall in mm; sunshine in hr

TABLE 3. continued.

Month: 2nd half of October 1971.

Day of the Month	Cleared site										Jungle site										Day of the Month
	Outdoor						In depot				In depot				Outdoor						
	Temperature		Humidity		Rain-	Sun-	Temperature		Humidity		Temperature		Humidity		Temperature		Humidity		Rain-		
	Max.	Min.	Max.	Min.	fall	shine	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	fall		
17	75.2	62.2	100	38	0.0	6.9	80.2	68.0	96	63	75.6	67.6	94	66	75.2	66.0	100	65	0.0		17
18	73.4	64.0	100	61	trace	3.0	78.8	71.2	93	75	73.4	68.4	95	89	73.4	67.8	100	100	trace		18
19	78.8	64.4	100	42	0.0	7.3	84.0	70.0	95	65	78.4	69.4	97	75	78.6	68.0	100	80	0.0		19
20	80.2	65.7	100	50	2.0	4.2	83.8	71.2	98	70	77.9	70.3	100	81	78.8	67.8	100	100	1.5		20
21	77.0	66.2	100	59	1.3	6.5	81.0	70.0	99	74	78.6	70.3	99	85	77.2	67.8	100	96	trace		21
22	77.0	64.4	100	47	0.0	6.8	80.6	70.0	94	65	76.6	69.4	95	74	77.0	66.6	100	88	0.0		22
23	78.4	63.1	100	41	0.0	8.0	82.4	69.4	93	60	77.7	68.9	93	68	76.6	66.0	100	68	0.0		23
24	79.0	66.2	100	42	0.0	5.2	84.2	71.6	86	60	78.4	70.5	90	70	77.0	67.5	100	74	0.0		24
25	69.8	65.8	100	97	33.0	0.1	75.2	70.2	99	94	73.8	71.6	100	97	70.7	67.6	100	100	22.8		25
26	77.0	66.9	100	60	1.3	5.7	81.5	71.6	100	93	77.4	72.5	100	87	75.2	68.9	100	100	1.3		26
27	70.2	64.6	100	84	0.0	0.0	75.2	70.0	97	86	74.3	70.7	98	94	70.7	67.1	100	100	0.0		27
28	66.4	64.2	100	100	19.0	0.0	71.6	69.3	100	96	71.6	69.6	100	98	68.2	66.2	100	100	12.0		28
29	65.3	60.8	100	100	41.9	0.0	69.8	66.2	100	97	69.8	66.0	100	99	67.3	62.6	100	100	29.2		29
30	65.5	57.6	100	75	0.2	0.0	70.7	62.6	100	82	68.0	63.5	100	92	66.0	60.4	100	100	1.3		30
31	72.9	61.0	100	52	0.0	4.9	75.2	66.2	95	67	71.6	65.8	96	80	69.4	63.5	100	100	0.0		31
Totals	This page				98.7	58.6													68.1		
	Brought forward				164.3	84.7													115.2		
	For the month				263.0	143.3													183.3		
	Monthly rain days				14														14		

N.B. Temperature in ^{o}F; humidity in per cent; rainfall in mm; sunshine in hr

TABLE 3. continued.

Month: 1st half of November 1971.

Day of the Month	Cleared site										Jungle site									Day of the Month
	Outdoor						In depot				In depot				Outdoor					
	Temperature		Humidity		Rain-	Sun-	Temperature		Humidity		Temperature		Humidity		Temperature		Humidity		Rain-	
	Max.	Min.	Max.	Min.	fall	shine	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	fall	
1	73.6	60.6	100	52	0.0	7.9	78.8	65.8	100	70	73.8	64.8	97	83	71.6	59.9	100	100	0.0	1
2	76.4	62.6	100	56	0.0	8.4	80.6	68.0	91	70	76.1	68.0	98	84	73.9	64.6	100	100	0.0	2
3	77.9	66.2	100	48	0.0	6.8	84.2	71.2	100	65	77.4	70.9	98	80	75.6	68.0	100	100	0.0	3
4	78.8	64.2	100	96	0.0	9.5	84.2	69.6	100	57	77.2	69.4	99	69	75.6	66.0	100	82	0.0	4
5	77.9	64.0	100	37	0.0	9.7	Instrument				78.6	69.6	96	68	76.8	66.2	100	80	0.0	5
6	77.2	63.0	100	49	0.0	8.5	out of				77.0	70.2	93	78	75.4	66.2	100	100	0.0	6
7	76.8	62.6	100	41	0.0	9.8	order				76.1	68.0	94	70	75.0	64.6	100	84	0.0	7
8	76.8	62.6	100	36	0.0	9.7	81.0	69.4	95	56	76.1	68.7	96	66	73.6	64.8	100	73	0.0	8
9	76.6	62.1	100	48	0.0	9.4	86.7	68.2	95	61	77.0	68.2	96	69	75.0	64.4	100	78	0.0	9
10	75.4	63.5	100	43	0.0	9.0	80.6	69.6	97	63	75.9	69.6	94	71	73.8	66.0	100	80	0.0	10
11	74.8	60.6	100	38	0.0	9.4	80.2	66.4	97	58	75.2	66.7	94	65	73.4	62.8	100	68	0.0	11
12	73.6	58.8	100	41	0.0	9.1	78.8	64.9	95	60	74.5	65.8	95	67	72.9	61.7	100	75	0.0	12
13	73.6	58.5	100	42	0.0	9.3	78.8	64.0	96	62	73.7	64.6	93	71	72.0	60.8	100	82	0.0	13
14	71.6	53.8	100	38	0.0	9.3	76.6	64.6	95	59	72.1	64.4	90	64	70.2	60.8	100	69	0.0	14
15	66.6	51.8	92	26	0.0	9.3	72.3	57.2	94	45	68.0	58.6	85	48	65.8	54.5	100	42	0.0	15
16	66.7	48.4	93	26	0.0	9.3	72.5	55.0	90	47	68.4	58.5	80	49	66.2	53.6	100	44	0.0	16
Totals	This page				0.0	144.4													0.0	
	Brought forward				-	-													-	
	For the month				-	-													-	
	Monthly rain days				-	-													-	

N.B. Temperature in ^{o}F; humidity in per cent; rainfall in mm; sunshine in hr

TABLE 3. continued.

Month: 2nd half of November 1971.

Day of the Month	Cleared site										Jungle site										Day of the Month
	Outdoor						In depot				In depot				Outdoor						
	Temperature		Humidity		Rain-	Sun-	Temperature		Humidity		Temperature		Humidity		Temperature		Humidity		Rain-		
	Max.	Min.	Max.	Min.	fall	shine	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	fall		
17	65.8	48.2	100	32	0.0	9.1	71.6	55.0	90	51	67.5	55.9	82	55	64.4	50.9	100	56	0.0		17
18	68.0	49.1	100	33	0.0	9.2	73.4	55.6	93	53	68.5	56.7	89	59	66.2	51.8	100	60	0.0		18
19	68.0	50.0	100	27	0.0	9.2	73.4	56.5	93	46	68.5	56.5	91	50	66.2	52.2	100	44	0.0		19
20	68.5	51.3	98	36	0.0	9.2	74.3	57.2	92	55	69.8	57.7	90	60	67.5	53.6	100	61	0.0		20
21	68.0	50	100	32	0.0	7.8	73.2	56.8	90	51	68.9	57.2	87	51	66.6	52.7	100	52	0.0		21
22	68.9	58.4	70	21	0.0	1.8	73.4	60.8	73	41	69.8	61.5	75	41	67.6	56.5	100	35	0.0		22
23	68.7	52.7	74	28	0.0	7.4	74.3	59.4	79	47	71.2	60.4	70	46	68.0	55.8	100	44	0.0		23
24	69.8	54.9	88	28	0.0	3.3	74.1	61.5	85	47	70.5	62.1	78	48	68.0	57.0	100	45	0.0		24
25	63.5	55.9	100	46	0.0	0.8	69.8	62.6	100	62	66.9	62.6	91	62	63.9	58.3	100	72	0.0		25
26	68.7	54.5	100	56	0.0	2.0	75.2	60.4	100	70	69.8	61.0	94	82	68.0	57.2	100	98	0.0		26
27	77.0	62.1	100	36	0.0	9.0	81.9	68.0	91	56	76.3	67.1	93	65	75.2	63.1	100	73	0.0		27
28	78.8	60.8	100	32	0.0	9.4	82.4	66.9	96	55	77.7	67.1	91	60	77.0	63.1	100	67	0.0		28
29	69.8	63.9	97	60	0.0	1.5	75.6	69.8	95	76	73.4	69.8	87	63	70.3	65.8	100	94	0.0		29
30	69.4	58.1	84	42	0.0	3.4	75.2	66.8	89	61	71.6	66.2	80	64	68.5	62.4	100	74	0.0		30
Totals	This page				0.0	83.1													0.0		
	Brought forward				0.0	144.4													0.0		
	For the month				0.0	227.5													0.0		
	Monthly rain days				0														0		

N.B. Temperature in ^{o}F; humidity in per cent; rainfall in mm; sunshine in hr

TABLE 3. continued.

Month: 1st half of December 1971.

Day of the Month	Cleared site										Jungle site										Day of the Month
	Outdoor						In depot				In depot				Outdoor						
	Temperature		Humidity		Rain-	Sun-	Temperature		Humidity		Temperature		Humidity		Temperature		Humidity		Rain-		
	Max.	Min.	Max.	Min.	fall	shine	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	fall		
1	69.8	52.7	100	40	0.0	7.8	75.2	59.0	95	60	70.7	60.8	87	66	68.4	56.3	100	77	0.0	1	
2	73.4	55.4	100	42	0.0	9.2	78.3	61.7	96	62	73.8	62.6	89	65	71.6	59.0	100	84	0.0	2	
3	72.6	59.4	100	46	0.0	6.1	78.3	65.7	95	65	73.4	65.5	89	73	71.6	60.1	100	90	0.0	3	
4	75.2	56.8	100	40	0.0	5.4	79.7	64.0	96	60	73.4	63.1	94	72	71.6	60.1	100	90	0.0	4	
5	77.0	60.1	100	37	0.0	9.1	82.4	67.1	95	59	77.0	66.0	95	65	75.9	63.0	100	74	0.0	5	
6	77.0	63.0	100	37	0.0	6.4	82.4	69.4	97	59	76.8	68.9	95	68	75.8	64.6	100	76	0.0	6	
7	77.2	61.7	100	34	0.0	8.0	82.4	67.6	97	58	77.2	68.4	94	64	75.2	63.9	100	71	0.0	7	
8	75.2	60.8	100	42	0.0	5.1	79.2	67.6	98	64	74.8	67.6	95	73	73.0	63.5	100	88	0.0	8	
9	73.4	59.5	99	43	0.0	4.0	78.6	65.7	96	64	72.3	64.8	92	75	70.5	61.9	100	88	0.0	9	
10	73.8	57.2	100	38	0.0	6.4	77.9	63.0	97	59	73.0	62.8	92	65	71.4	59.9	100	75	0.0	10	
11	73.2	57.4	100	41	0.0	5.4	77.4	62.8	96	60	81.9	62.6	90	67	71.4	60.3	100	81	0.0	11	
12	72.1	55.4	100	27	0.0	9.4	76.8	61.0	96	47	72.1	62.1	88	50	71.2	59.0	100	48	0.0	12	
13	71.6	55.2	100	39	0.0	9.5	76.6	60.6	95	53	72.0	61.0	88	57	70.0	60.8	100	57	0.0	13	
14	73.4	53.8	100	42	0.0	9.2	78.1	60.6	95	55	73.0	60.8	91	60	70.7	55.9	100	64	0.0	14	
15	75.2	58.8	100	49	0.0	5.0	79.3	64.6	97	62	74.8	64.4	91	70	72.5	60.6	100	76	0.0	15	
16	73.4	57.2	100	40	0.0	7.5	77.9	62.8	96	53	73.4	62.8	88	56	71.4	59.2	100	58	0.0	16	
Totals	This page				0.0	113.5															
	Brought forward				-	-													0.0		
	For the month				-	-													-		
	Monthly rain days				-	-													-		

N.B. Temperature in ^{o}F; humidity in per cent; rainfall in mm; sunshine in hr

TABLE 3. continued.

Month: 2nd half of December 1971.

Day of the Month	Cleared site										Jungle site										Day of the Month
	Outdoor						In depot				In depot				Outdoor						
	Temperature		Humidity		Rain-	Sun-	Temperature		Humidity		Temperature		Humidity		Temperature		Humidity		Rain-		
	Max.	Min.	Max.	Min.	fall	shine	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	fall		
17	71.8	53.2	100	36	0.0	9.3	76.8	59.7	93	50	70.7	60.3	85	56	68.7	55.8	100	58	0.0		17
18	70.2	54.9	100	45	0.0	0.5	76.1	61.7	90	58	70.7	61.7	91	60	68.4	57.0	100	72	0.0		18
19	75.2	60.8	100	43	0.0	3.1	77.1	61.5	92	58	74.3	63.5	90	65	71.8	62.4	100	72	0.0		19
20	64.4	57.2	100	70	0.0	0.0	69.8	63.8	100	82	66.2	62.6	97	88	64.4	59.7	100	100	0.0		20
21	69.8	55.4	100	48	0.0	2.7	73.8	61.3	100	65	69.8	60.8	97	74	68.0	58.1	100	88	0.0		21
22	72.5	60.1	100	48	0.0	4.4	77.0	64.0	95	63	71.6	63.1	92	72	70.2	60.8	100	100	0.0		22
23	78.4	59.9	100	34	0.0	4.6	85.1	66.2	96	50	75.7	65.5	94	63	74.1	62.2	100	66	0.0		23
24	82.0	59.9	100	33	0.0	7.7	87.8	66.2	96	50	78.8	66.2	94	62	77.3	62.2	100	66	0.0		24
25	80.6	62.6	100	38	0.0	6.1	86.0	69.8	95	65	77.4	69.4	91	67	75.6	65.3	100	80	0.0		25
26	80.6	64.9	100	44	0.0	8.0	87.8	72.7	91	55	77.7	71.6	91	74	75.2	68.0	100	94	0.0		26
27	80.2	66.3	100	62	10.2	8.6	80.6	65.0	100	70	75.2	68.2	97	80	73.0	60.2	100	100	11.4		27
28	60.8	55.9	100	80	0.0	0.0	66.7	62.2	95	81	68.0	62.1	92	86	60.8	57.9	100	100	0.0		28
29	70.7	55.4	100	51	0.0	2.5	77.5	60.8	100	62	69.3	60.8	97	77	69.5	57.2	100	90	0.0		29
30	73.4	57.3	100	40	0.0	6.9	79.9	62.6	94	53	71.2	62.6	92	65	69.8	59.0	100	69	0.0		30
31	74.3	54.7	100	36	0.0	9.2	78.8	60.8	98	50	72.9	60.8	94	56	71.6	56.5	100	57	0.0		31
Totals	This page				10.2	73.6													11.4		
	Brought forward				0.0	113.5													0.0		
	For the month				10.2	187.1													11.4		
	Monthly rain day				1														1		

N.B. Temperature in ^{o}F; humidity in per cent; rainfall in mm; sunshine in hr

TABLE 3. continued.

Month: 1st half of January 1972.

Day of the Month	Cleared site										Jungle site									Day of the Month
	Outdoor						In depot				In depot				Outdoor					
	Temperature		Humidity		Rain-	Sun-	Temperature		Humidity		Temperature		Humidity		Temperature		Humidity		Rain-	
	Max.	Min.	Max.	Min.	fall	shine	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	fall	
1	72.0	53.6	100	28	0.0	9.2	77.4	59.9	93	45	70.3	60.8	86	49	69.3	56.7	100	44	0.0	1
2	73.0	50.0	100	29	0.0	9.2	80.2	56.5	95	45	70.2	57.2	89	54	68.7	52.5	100	48	0.0	2
3	76.5	52.7	100	18	0.0	9.0	81.9	59.9	90	35	73.4	65.1	95	42	71.8	55.2	100	31	0.0	3
4	78.6	56.5	100	17	0.0	9.5	84.4	63.5	82	35	74.8	62.8	81	40	73.4	57.4	100	28	0.0	4
5	78.6	60.3	100	29	0.0	9.3	84.6	64.0	84	42	76.1	63.5	89	49	73.8	58.3	100	43	0.0	5
6	76.5	57.0	100	34	0.0	7.7	81.5	63.5	98	50	75.0	63.9	91	59	73.4	58.8	100	55	0.0	6
7	74.8	54.9	100	32	0.0	8.7	79.2	61.8	99	50	72.9	61.0	94	59	71.4	57.0	100	56	0.0	7
8	72.5	53.8	100	34	0.0	8.0	77.0	60.6	96	51	71.1	60.8	92	59	69.8	56.7	100	53	0.0	8
9	71.8	51.6	100	29	0.0	9.0	76.8	57.6	99	46	69.4	57.2	94	55	68.0	53.8	100	50	0.0	9
10	72.5	50.2	95	22	0.0	9.2	78.4	55.9	97	41	70.5	57.2	92	49	68.2	51.8	100	39	0.0	10
11	71.8	50.0	100	22	0.0	8.8	76.8	57.0	95	43	70.0	57.4	90	48	67.8	51.8	100	37	0.0	11
12	71.8	50.9	100	22	0.0	9.2	77.9	56.3	94	39	71.6	57.2	91	42	69.1	51.8	100	30	0.0	12
13	71.6	50.4	100	26	0.0	9.2	77.0	56.3	96	42	71.1	57.2	90	46	68.2	51.6	100	34	0.0	13
14	72.7	50.2	100	28	0.0	8.3	76.1	55.8	91	44	70.0	57.2	81	48	68.0	51.8	100	38	0.0	14
15	64.6	46.4	100	30	0.0	6.9	69.8	52.3	94	49	64.8	54.5	82	53	62.6	48.2	100	42	0.0	15
16	69.6	46.0	100	30	0.0	9.1	75.4	52.2	95	47	68.0	53.8	88	55	66.0	48.2	100	48	0.0	16
Totals	This page				0.0	140.3													0.0	
	Brought forward				-	-													-	
	For the month				-	-													-	
	Monthly rain days				-	-													-	

N.B. Temperature in ^{o}F; humidity in per cent; rainfall in mm; sunshine in hr

TABLE 3. continued.

Month: 2nd half of January 1972.

Day of the Month	Cleared site										Jungle site										Day of the Month
	Outdoor						In depot				In depot				Outdoor						
	Temperature		Humidity		Rain-	Sun-	Temperature		Humidity		Temperature		Humidity		Temperature		Humidity		Rain-		
	Max.	Min.	Max.	Min.	fall	shine	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	fall		
17	70.0	51.3	100	34	0.0	3.3	76.2	57.7	95	52	70.2	57.2	93	68	68.0	53.2	100	52	0.0		17
18	74.8	52.3	100	26	0.0	9.2	80.6	60.3	86	43	73.9	59.9	85	47	71.6	54.0	100	38	0.0		18
19	77.7	55.4	100	26	0.0	9.2	84.2	62.6	85	41	77.0	62.6	82	45	75.2	57.2	100	36	0.0		19
20	76.3	54.5	100	22	0.0	9.2	82.0	61.9	80	37	76.3	61.7	80	39	73.9	55.4	100	28	0.0		20
21	76.1	53.6	100	26	0.0	9.2	82.0	60.8	92	41	73.8	60.8	85	49	71.6	55.4	100	40	0.0		21
22	75.2	51.3	100	22	0.0	9.1	81.3	59.9	94	41	73.8	60.8	86	49	71.6	54.7	100	40	0.0		22
23	81.5	54.0	100	24	0.0	9.2	87.3	61.3	85	35	77.9	61.3	80	40	75.2	55.4	100	28	0.0		23
24	82.4	56.3	100	16	0.0	9.2	88.2	62.6	80	32	78.8	63.5	84	37	77.0	57.2	100	26	0.0		24
25	72.9	68.5	100	20	0.0	9.2	87.8	65.5	82	37	79.3	65.3	79	45	77.0	59.9	100	30	0.0		25
26	82.4	59.7	82	24	0.0	9.2	88.7	67.1	71	39	80.6	66.2	72	41	78.8	59.9	100	32	0.0		26
27	80.1	60.1	100	40	0.0	7.5	86.0	68.0	89	51	78.8	68.0	83	56	77.0	61.9	100	56	0.0		27
28	80.6	57.9	100	32	0.0	9.2	86.0	67.6	87	50	79.3	66.7	90	55	77.0	61.3	100	52	0.0		28
29	82.4	60.8	100	32	0.0	9.2	89.2	68.4	90	48	80.6	68.0	87	55	78.8	62.6	100	52	0.0		29
30	86.5	63.5	100	22	0.0	9.2	90.9	69.8	93	39	83.5	69.8	90	43	81.5	64.4	100	36	0.0		30
31					0.0	8.2											100		0.0		31
Totals — This page					0.0	129.3															
Totals — Brought forward					0.0	140.3													0.0		
Totals — For the month					0.0	269.6													0.0		
Totals — Monthly rain days					0														0.0		
																			0		

N.B. Temperature in ^{o}F; humidity in per cent; rainfall in mm; sunshine in hr

DISCUSSION

Discussion of visual observations and weight changes

Most of the samples show weight increases too great to be attributed to weighing error which, probably, does not exceed 0.03 g. The nature of all the samples is such that they can be expected to be hygroscopic and the weight increases can probably all be attributed to aquisition of water. All packages are sealed. In the cases of samples contained in plastic bags and paper bags permeation of the plastic and paper by atmospheric water vapour, over the period of exposure, might be sufficient to account for the observed increase in weight, even if the bags remained perfectly sound. However, in the case of samples contained in aluminium packages, weight changes of the magnitude observed must indicate perforation of the containers. Leakage of greasy or syrupy material was observed, though not recorded, in some cases.

It was observed that ants are quite competent to bite through all three containing materials. Closer inspection would, probably, have revealed more extensive ant damage than has been recorded. Visual examination of banana jam samples belonging to the third withdrawal revealed that many of the plastic bags had been inadequately sealed at the outset. The same presumably applies to the corresponding samples of the second withdrawal. Flexure of the aluminium packages during handling and transport might cause cracking along the creases.

Comparison between the conditions of samples stored at the three sites does not reveal any obvious differences in severity of exposure. However, any such comparison is rendered difficult by the indiscriminate damage done by ants at ASRCT, Bangkok before and after the exposure period.

Large weight decreases shown by a few samples probably indicate removal of food by ants.

Discussion of microbiological observations

Samples were withdrawn from storage under test conditions on 17 January 1972 but, unfortunately, it was not possible to make microbiological tests on them until April, May and June 1972. During the intervening period the samples were stored in the cool room at ASRCT, Bangkok

where it is hoped that their microbiological condition did not change appreciably.

The results do not give any cause to consider that the samples have become unfit to eat. There are no positive results for coliform tests and only a few positive for anaerobic tests. Except in the case of one sample (5-3-6-I-LaB1 for which a count of more than 300,000 colonies of mold per gramme was obtained) counts of total aerobic bacteria and total mold are all less than 10,000 colonies per gramme. These counts are considered quite acceptable and that for sample 5-3-6-I-LaB1 might be erroneous.

There is little or no evidence, at this stage, to show changes with time in microbiological populations or differences to be correlated with site of "exposure". The only conspicuous distinction between samples is that the powdered variety of survival ration No. 3 seems to be generally more highly infected than other survival ration samples.

Discussion of meteorological data

The period between the first and second withdrawals falls mostly in the cool, dry season (unlike the period up to the first withdrawal). Lack of rainfall is not directly significant for these samples which were all stored under shelter in depots. However, all forms of vermin are less active at this time of the year. The humidity rose to high levels each night, through most of the period, even in the absence of rainfall. Temperatures over this period are comparatively low indicating that deteriorative changes should be slower at this time of the year. It is notable that, although on most nights the humidity out of doors reached 100%, it usually did not do so in the depots. This should be a significant aspect of the protection afforded by the depots. The depots exclude direct sunlight. Radiative heating of the roofs and walls of the depots causes the interior temperature of the cleared site depot to be considerably higher than ambient during daytime and that of the jungle depot a little higher than ambient.

CONCLUSION

At this stage it is already evident that the packaging of these samples does not provide adequate protection under the conditions of test. Probably, most containers have become perforated allowing ingress of insects and moisture. Although the samples still appeared edible at the time of testing, their ultimate deterioration to the point of uselessness would undoubtedly have been hastened by the inadequacy of the containers.

At the time of testing, leakage and insect infestation had already rendered the samples unappetizing. It may be argued that aesthetic appeal is not essential in combat or, particularly, survival rations. Nevertheless, it seems preferable not to forfeit aesthetic appeal unnecessarily.

The authors suggest two alternative ways of coping with the container problem, viz. 1) The samples could be packed in more robust containers. This would involve the penalty of considerably increased cost and weight. It might also render survival rations inaccessible to a soldier who had lost all equipment with which he might open "robust containers". 2) A number of packages, similar to those tested, could be packed for storage in larger (e.g. 5 kg or 25 kg) containers which would be insect and moisture proof, e.g. tin cans with tight fitting lids could be used.

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APPENDIX

TEST PLAN

SAKAERAT EXPERIMENT STATION

APPLIED SCIENTIFIC RESEARCH CORPORATION OF THAILAND

Preserved foods
(Combat and survival rations)

1. Sponsor — Preserved Food Organization

   Manufacturer — Preserved Food Organization

2. Purpose — To study the changes in physical and chemical properties of combat and survival rations when stored under different conditions over different lengths of time.

   - To determine their shelf lives.
   - To study microbiological growth.

3. Scope of trial

Number of types	9
Number of replicates	4
Number of withdrawals	8
Number of sites	2
Number of specimens	
On sites	576 cleared, 576 jungle
Controls	288
Number of specimens subjected to tests prior to exposure	36
Total	1476

4. Exposure — Sites: cleared, 50 x 50 metre area.
   Jungle, adjacent to the cleared site.

   Methods: specimens contained in cardboard boxes and stored in shelters, simulating field storage, and in an air-conditioned room.

Controls: kept in the air-conditioned room about 250 metres away from the cleared site.

Specimens
- 5-2-1, Dehydrated, cooked rice
- 5-2-4, Banana jam
- 5-3-1, Survival ration No. 1 in bar form
- 5-3-2, Survival ration No. 2 in bar form
- 5-3-3, Survival ration No. 2 in powder form
- 5-3-4, Survival ration No. 3 in bar form
- 5-3-5, Survival ration No. 3 in powder form
- 5-3-6, Survival ration No. 4 in bar form
- 5-3-7, Survival ration No. 4 in powder form.

5. Assessment — Visual on site
Weight changes
Microbiological growth.

6. Withdrawal Programme — 2 years with withdrawals at 3 monthly intervals.

7. Meteorological Data — Routine.

8. Reports — At each withdrawal.