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TITLE

THE EFFECT OF SEVERE WINTER CONDITIONS IN CANADA ON THE ANTI-GAS EQUIPMENT AS
ISSUED TO THE CANADIAN ARMY

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EXPERIMENTAL STATION
SUFFIELD, ALBERTA

DIRECTOR GENERAL
DEFENCE RESEARCH
DEC 17 1947

SUFFIELD REPORT NO. 18

SUMMARY

In order to study the effect of severe Canadian winter conditions on the anti-gas equipment as issued to the Canadian Army, a test was carried out. For one test six men were used and for the other eighteen men.

Respirators functioned satisfactorily except that vision was considerably impaired due to frosting of the eye pieces.

Anti-gas ointment used while in the frozen state was found to melt readily and it was also found that its effectiveness was practically unimpaired.

It was found most desirable to carefully shake out any accumulated moisture in the respirator face piece and to wipe it dry before putting it away in the haversack, as otherwise, there was danger of the outlet valve freezing.

These experiments were carried out in temperatures ranging from -6° F to -11° F. The wind velocity reached up to 25 M.P.H.

Respirators gave complete protection in gas chamber tests at low temperatures.

H.M. Barnett
Sup't Research

For (J.E.L. Davies)
Chief Superintendent,
Experimental Station

AAH/TJ

Classification / designation U/U
Changed to / Remplacé par
By authority of C. LaSorce
Sup't Authorisation de
24 Feb 98 Signature D. Kuseler
Appointment
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SES
REPORT
18

1946/1845

EXPERIMENTAL STATION

SUFFIELD, ALBERTA

SUFFIELD REPORT NO. 16
SERIAL NUMBER
DATE: June 9, 1942.

THE EFFECT OF SEVERE WINTER CONDITIONS IN CANADA

ON THE ANTI-GAS EQUIPMENT AS ISSUED TO THE CANADIAN ARMY

1. OBJECT

To study the effectiveness of Respirator, Anti Gas and associated equipment under winter conditions and the effectiveness of Anti-Gas Ointments Nos. 2 and 3 in frozen condition. (Field Experiment No. 12).

- (1) The reduction of vision due to frosting of the eye piece when the respirator is worn in cold weather.
 - (a) Without treatment anti-dim.
 - (b) With treatment anti-dim.
 - (c) With celluloid insert in glass with eye piece without anti-dim.
 - (d) Celluloid insert with air space between insert and eye piece.
- (2) The effect of cold weather on the general efficiency of the face piece.
 - (a) During wearing.
 - (b) In storage after wearing.
- (3) Efficacy of Ointment Anti-Gas while in a frozen state.

2. PROCEDURE AND RESULTS

On January 7th, 1942, six men were used; three applied anti-dim, three did not. Of the men who applied anti-dim, two wore their haversacks under their great coats and one wore his on the outside. The other three men who did not apply anti-dim wore their respirators in the normal aler position outside their great coats. The respirators were put on at 1420 hours and at 1425 two respirators with anti-dim were clouded. At 1440 hours, one respirator with anti-dim and one without anti-dim were clouded. At 1450 hours one of those without anti-dim was so frosted the wearer could not see. At 1455 hours one respirator with anti-dim was so frosted the wearer could not see. At 1500 hours all the eye pieces were frosted, four very badly, whilst two still allowed slight vision. The two observers who had slight vision had applied anti-dim and wore their haversacks under-neath their great coats.

Meteorological Conditions:-

During these experiments, the temperature varied from -6°F to -11°F. The wind velocity reached up to 25 m.p.h.

PROCEDURE & RESULTS (Contd.)

On February 17th, 1942, the experiment was carried further and the procedure was as follows:

(a) During this experiment eighteen observers in all were used. Four did not apply anti-dim, six used cold anti-dim, three used celluloid inserts in the right eye pieces, three used the celluloid insert in the right eye piece treating it with anti-dim, two used celluloid in the right eye piece forming an air space between the insert and the glass eye piece, by inserting a standard rubber ring. The observers were exposed for 25 minutes and were observed at various periods. At the expiration of the 25 minutes, 10 returned their respirators to their haversacks without treatment, three put them away after shaking out condensed water, three others carefully wiped out face pieces and then put them away. After a further expiry of 40 minutes, the respirators were put on and tested in the gas chamber for leakage and clogging of the outlet valve. When the men were not wearing face pieces, their faces were continuously examined for frost bite.

The test of Ointment Anti-Gas was conducted as follows:

Six observers were contaminated with two drops of Mustard at a room temperature of 70°F and after a short interval ointment was applied to one of the contaminated areas. Ointments Anti-Gas Nos 2 and 3 were used, both frozen at outdoor temperature of -6°F. Ointment No. 2 was frozen very solid, but Ointment No. 3 was still plastic. In each case approximately one ccm of ointment was applied and well rubbed in. It was allowed to remain on the skin for about an hour. It was noted that both ointments melted quickly and spread well on the skin. Appendix B shows the results in tabular form.

3. CONCLUSION

The equipment anti-gas issued to the Canadian Army under low temperature conditions provides several problems.

It appears that the application of anti-dim does to some extent prevent frosting of eye pieces under extreme cold weather.

The vision of the troops wearing respirators would be reduced to almost nil in approximately ten minutes. One of the observers by employing special methods of exhaling (exhaling upwards through the mouth forcibly so that the effect was that of blowing on the eye piece) maintained vision practically throughout the test.

The use of celluloid inserts inside the eye piece caused a slight improvement, particularly if the celluloid is treated with anti-dim. The improvement is of very short duration, such as 1 to 2 minutes.

If the respirator is put away after wearing in cold weather there is danger of freezing up the outlet valve. Careful wiping of the face piece is of assistance in preventing such freezing. Further, when the valve is frozen, the exhaled air escapes from the side of the face piece until warmth of the breath frees the diaphragm. When respirators were tested with C.A.P. there was no indication of leakage. It is possible that a more severe test, such as chlorine, might indicate leakage.

It would appear that immediately after the removal of the face piece, the observers are more subject to frost bite.

APPENDICES

Appendix "A" shows photographs of eye pieces during the test. Note frosting of glass.

Appendix "B" shows respirator tests in gas chamber together with observations during exposure.

Appendix "C" shows in tabular form, the efficiency of Ointments, Anti-Gas, Nos. 2 and 3.

The above experiments were carried out by W/C. O.M. Fraser, R.A.F., Major J.S. Campbell, R.A., Capt. J.T. Hugill, R.C.A. and H.H. Watson, Esq., Physics and Meteorology Section. This report was written by Major A.A. Heesmerle, 17th D.Y.R.C.H.

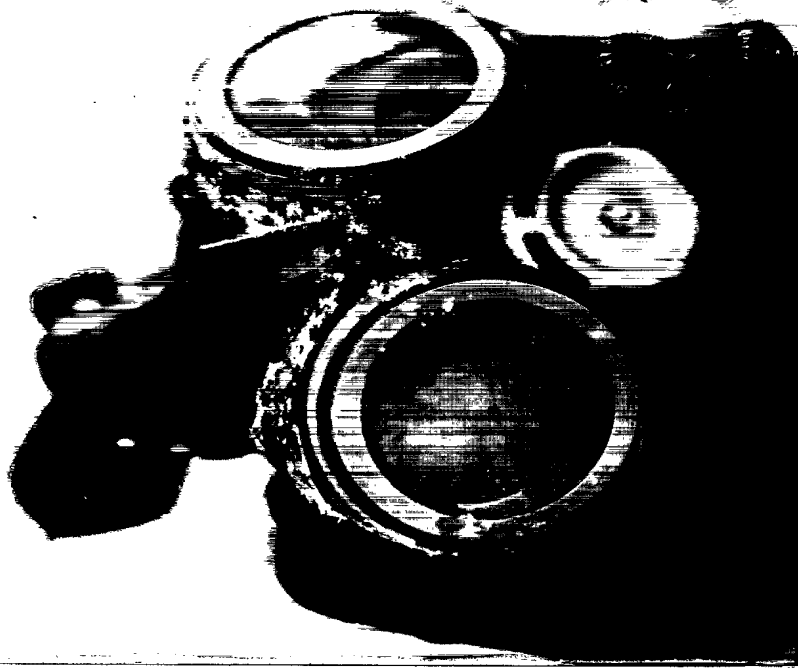
H.M. Barnett
2-17-1918

for (E.L. Davies)
Chief Superintendent,
Experimental Station.

AAH/SB

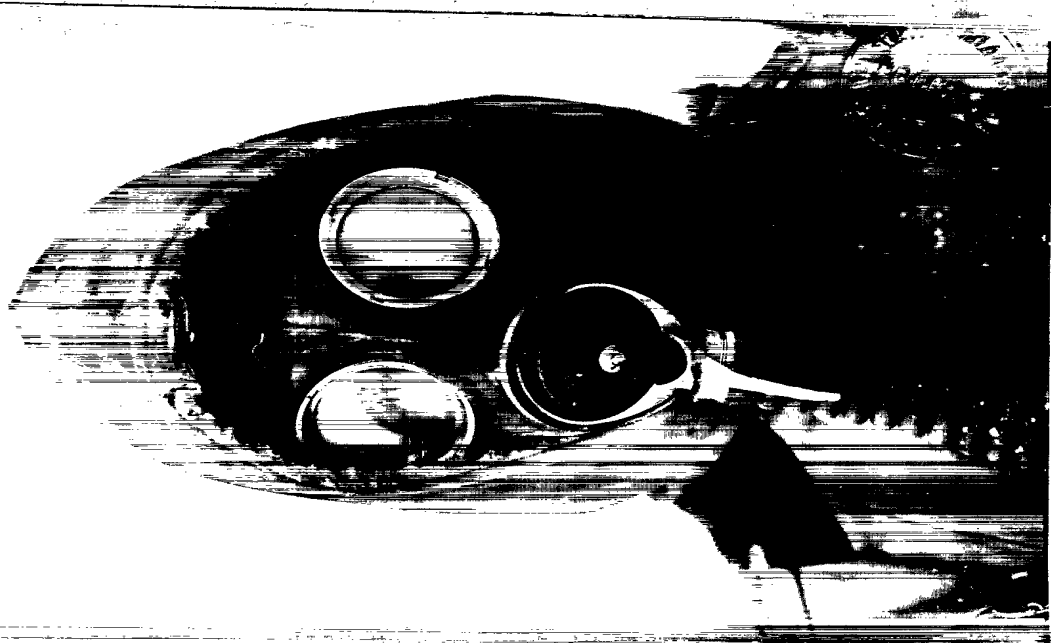
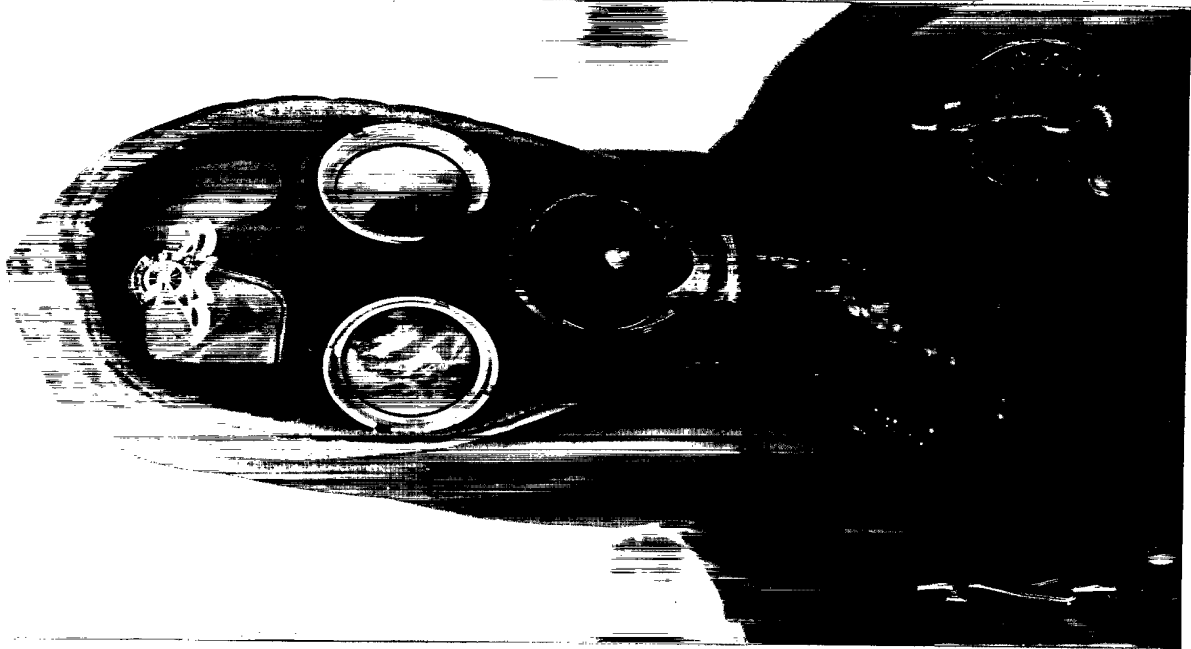
Experimental Station,
Suffield, Alberta.

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APPENDIX "A"



SUFFIELD REPORT NO. 18. Appendix "B".

TABLE OF RESPIRATOR TESTS IN COLD WEATHER
 Chemistry Section, Experimental Station.
 February 16th, 1942.

Weather -10°F. Wind 25 m.p.h.

Observer **McDerm**

Procedure prior to test

Preparation for Test

Observations on Eyepieces and Valves

3 minutes marching

10 minutes marching

25 minutes marching

Remarks

Preparation for further tests

Further testing

Outlet valve (F = free or clear)

Remarks

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
 All respirators kept outdoors for 11 minutes!

Celluloid in right eye-piece. Respirator outdoors 11 minutes	Celluloid in right eye-piece anti-dimmed. Respirator outdoors 11 minutes
--	--

None Anti-dim applied cold None

0 1/2 1/4 0 1/2 0 1/2 1/2 1 1 1/2 1/2 1 1 3/4 3/4 3/4 1/2	1 1 7/8 1 1 1 1/2 1 7/8 1 1 7/8 1 1 3/4 1/4 1/4 3/4
0 0 0 0 1/2 1/2 1 0 1 0 1 1 1 1 1 1 1 1	(Some few showed moisture, a few showed single icicles; none were clogged)
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	(All showed distinct icicles, up to 1 inch long, below valve; none were clogged)
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	(All valves heavily iced, but there was no sign of clogging.)

With the exception of Number 8, all men were in effect blind, and had to be led about.

Respirators put in haversacks	Respirators shaken out and put in haversacks	Respirators wiped out and put in haversacks	Respirators put in haversacks
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Respirators in haversacks left outside for 40 minutes, put on and tested out in cold gas chamber with C.A.P. cloud.

F	C	C	F	C	C	F	C	C	F	C	C	F	C	C	F	C	C
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

In cases where the outlet valves were clogged the exhaled air escaped around the sides of the facepiece. There was no leakage noted into the facepiece. All outlet valves became clear after 3 to 10 minutes wearing.

SUFFIELD REPORT NO. 18.

APPENDIX "C"

OINTMENT ANTI-GAS FROZEN

A trial was carried out on 17/2/42 to determine the efficacy of Ointment Anti-Gas No. 2 and No. 3 while in a frozen state.

Six observers were contaminated with two drops of pure mustard at room temperature (70°F) and after an interval the ointment under test was applied to one of the contaminated areas. Ointment Anti-Gas No. 2 was frozen solid at outdoor temperature (-6° Fahr) but Ointment Anti-Gas No. 3 was still plastic. In each case a mass of ointment about 1 cm. diameter was applied and well rubbed in, and allowed to remain on the skin for about an hour. Both ointments melted quickly and spread well on the skin.

The results are shown below.

Observer	Interval between contamination & application of Ointment.	Control Area at 24 hrs.	Test Area at 24 hrs.
A	1 minute No. 2 H-2 mm. drop	E+3 x 3 cm. V 1.8 x 2.2 cm. Central necrotic area	E 1.5 x 1.8 cm.
B	2 mins. No. 2 H-2 mm. drop	E+3.5 x 2.5 cm. V 2.3 x 1.4 cm.	E 1.4 x 0.7 cm.
C	5 mins. No. 2 H-2 mm.	E+4 x 2.5 cm. V 2.3 x 1.5 cm.	E - 1.5 x 1.4 cm. Pinpoint vesicle.
D	1 min. No. 3 H-2 mm. drop	E - 1.5 x 1.8 cm. V 1.4 x 1.5 cm.	E - 0.8 x 0.4 cm.
E	2 min. No. 3 H-2mm. drop	E+2.0 x 2.5 cm. V 2.0 x 1.8 cm	E - 0.3 x 0.3 cm.
F	5 min. No. 3 H-2 mm. drop	E+5.0 x 6.0 cm. V 3.0 x 2.7 cm. Necrotic area 2.5x2cm.	E - 3.5 x 2.5 cm. V 2.5 x 1.4 cm.

It will be seen that the ointments retains almost full efficiency except Anti-Gas No. 3 in the case of observer F.

*E.C.W. Report
1200k*

Add the following:-

SUMMARY

At end of second paragraph add:

"The insertion of a second eye-piece disc, mounted inside the respirator so as to hermetically seal an air-space between two thicknesses of glass proved very effective in keeping eyepieces clear at -10°F ."

SECTION I OBJECT

After 1 (a) add

"(e) Glass insert with hermetically sealed air space between it and the normal eyepiece."

SECTION 2 PROCEDURE AND RESULTS

P.2, after line 16, ending "continuously examined for frost-bite" add:-

"In view of the failure of the celluloid inserts to prevent frosting, it was decided to check the results given in Ptn. 27/P.22951 in which it is reported that a double glass eye-piece with an intervening air space prevented fogging in a temperature as low as -38°F ."

Consequently the left eyepieces of 6 facepieces were fitted with another glass disc (standard eye-piece disc) the additional disc being held firmly in position on the metal seating within the facepiece by surgical tape. Some care was taken to seal perfectly the air space, and this was done indoors at a temperature of 70°F with a relative humidity of about 25 per cent.

The inner surface of each eyepiece was carefully anti-dimmed. Three respirators were adjusted indoors, the observers moving outside at once into a temperature of -10°F ; the other three adjusted their respirators out of doors, the respirators having been left there previously for about 15 minutes. Haversacks were worn outside great-coats.

The observers were kept marching for one hour (-10°F) in a wind of 4 m.p.h.

The right eyepiece (single glass) of all fogged and iced up within 10 minutes. Two of those who adjusted their respirators indoors reported slight fogging of the left eye-piece for a short while at about 10 minutes from zero; they were quite clear again at 15 minutes from commencement of test, and remained so for the duration of the test.

After marching for one hour, the observers moved into a building at 90°F ; the right eye-pieces became quite clear of fog within 15 minutes and remained so for a further hour at which time the test was discontinued.

It may be concluded that the eyepieces of British respirator facepieces, Mks. 4 and 5, can be prevented from fogging and frosting up at -10°F (and probably at much lower temperatures) by introducing a second layer of glass on the inside of the respirator, separated from the normal eyepiece disc by a thin air-space, the air-space being hermetically sealed. Insertion of a second eye-piece disc is quite satisfactory for this and causes no wearing difficulties.

It is thought that had the celluloid inserts been fitted separated from the inside of the eyepieces by a hermetically sealed air-space, they would have been as effective as the double-glass windows."

These experiments carried out by Mr. H.H. Watson were inadvertently omitted from Suffield Report 18.

H.M. Barrett
(H.M. Barrett) Supt. of Research,
for (E.Ll. Davies) Chief Superintendent,
Experimental Station.

H.M. Barrett
(H.M. Barrett) Supt. of Assoc.
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Omitted from Sullivan Report 18.

SECRET

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Omitted from Sullivan Report 18.

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