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for PEACE OF MIND-BUY SAVINGS BONDS

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28 March 1947

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DOE-OR * 0800004647 *

Major William R. Clarkson, MC, USA
Executive Officer, Medical Division
Oak Ridge, Tennessee.

Subject: Combat Mask and K-25.

Dear Major Clarkson:

I regret very much the delay in forwarding this information. The pressure of time, the dispersal of the stowing place for this as yet unreported material in other offices which are not associated with Crossroads and the fact that the report is still in an uncompleted state have all contributed, much to my embarrassment and disappointment.

The M-11 canister employed on the U.S. Army Assault Mask gave adequate protection for all intensities of exposure to C-616 and its products at the "thermal diffusion" plant in Philadelphia between 1 November 1944 and 31 December 1945. In October 1944 I reviewed the canister situation in relation to the information then available as to C-616, C-216, HF, and TO_2F_2. Satisfied that the canister would be effective, I subjected myself to increasingly higher concentrations of the C-616, and its products of hydrolysis. Even with a cloud so dense you could not see your hand held two feet from the face there was none of the irritating effect which would indicate any corrosive gas or particulate coming through nor was there any of the characteristic taste which one obtains from the "material" and which in low concentrations is detectable by the experienced person and which most characteristically at the base of the tongue.

Using an assault mask and M-11 canister, Dr. Abelson exposed himself to the conditions created by the release of C-216. The intensity was such that in about four minutes the skin on his body began to feel warm and creepy. He withdrew at this warning signal. There still was no evidence of any C-216, or of its products coming through the canister.

There may be some confusion regarding the terms Assault and Combat Mask. The mask was initially introduced as "Assault Mask". In November 1944 we were advised by C.W.S., U.S. Army, this was to be changed to "Combat Mask". We then used the latter term. Subsequently, it was decided not to produce the "Combat Mask", which was to have had some

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minor improvements over the "Assault Mask". We have just been advised by Chemical Corps, U. S. Army that the mask should still be referred to as "Assault Mask". In our safety instructions and reports the "Combat Mask" is referred to in accordance with our earlier advice. Wherever we say "Combat Mask", we therefore mean "Assault Mask".

The B-2 canister of the Navy, N.D. Mark III would probably give a similar protection but we have not conducted any significant studies with it. Others may have.

The M-11 canister has cellulose filter of good characteristics, and will remove particles down to .2 or .3 microns. The B-2 for Navy N.D. Mark III Mask will do much the same.

The M-11 canister has an activated charcoal of high quality treated chemically and referred to as A.S.C. Whethrite.

I am convinced that with proper use of the mask and canister referred to, all inhalation hazards arising directly or indirectly from C-616 can be met with proper and adequate protection. Fourteen months of use of this mask and canister in the "Thermal Diffusion" plant has proved the adequacy of this means of protection. Following the adoption and use no respiratory injuries occurred and it was possible to enter an area of dense C-616 cloud to prevent escape of the material with complete safety to personnel, and with valuable conservation of the material escaping. This was done repeatedly.

I would be derelict if I were not to mention the basic and vital necessity for (a) plan for safety, (b) training in the care, use and indications for use of the mask, (c) supervision in safety precautions and (d) leadership and support top side. Early in 1945 I went to K-25 to initiate training in use of the mask for that specific area and plant. I met with as fine a group of leaders and safety personnel as I have ever had the pleasure of working. In their hands I am certain the mask can and did do proper service.

The ad seriatim health studies conducted on personnel employed in the "thermal diffusion" plant in Philadelphia from 1 November 1944 to 31 December 1945 bear unmistakable evidence of the safety afforded by this mask and canister.

The most sensitive test of the presence of C-616 or its products is the change in color in the flame of a Bunsen burner which gives a F color at 3 milligrams per cubic meter of air. This amount represents the amount of C-616 released in the air.

[redacted]

C-616 is barely detectable by a combination of taste and flame color at 10 milligrams per cubic meter. The taste is a weak, barely detectable faint odor or taste. (It is difficult to say whether it is taste or odor - like fine wine). It is best detected along the base of the tongue laterally and in the nasopharynx. It tends to persist. Best brought out by inhaling through mouth and exhaling through nose. The phenomena of olfactory or taste fatigue does NOT occur as in mustard gas. The taste persists for hours if the concentration is higher but not at this level.

There is a clear cut recognition with characteristic pungency at 20 to 30 milligrams per cubic meter. If at this concentration the skin is moist and perspiring and perhaps a little erythema may be noted, there is not apt to be any visible cloud at this concentration.

A Tyndall beam effect is observed when a flash light is used and the concentration is 100 milligrams per cubic meter. The cloud is barely detectable without a flashlight or light beam. Even in this concentration the irritation, while not really pleasant, is far from unbearable, either in limited inhalation or on the sweating skin.

These observations made with Temperature 58°F. and Relative Humidity 70%.

150 micrograms per cubic meter has been taken as the level of safety for avoidance of chronic effects.

For short, acute exposures, a cloud which is sufficient to cause withdrawal from the area because of the unpleasantness of the pungency on inhalation will produce nothing more than mild transient and localized irritation.

Assault Mask M5-11-7 was the one employed at Philadelphia.

At Rochester, the Army M-IX was tested separately on C-716 and C-816. This is described in Rochester Inhalation Section Report #30. It was found superior to Willson Universal and Acme Universal canisters. This was to be expected.

Rochester Report M-1648 (also their local Inhalation Section Report #25) describes T and C-216 retained in U.S. Army Assault Mask canisters used for short periods in high concentrations of C-616. Filter was cellulose of very fine mesh. Charcoal was "whetlerite". These canisters were exposed and adjusted to faces of two men, for 2 to 3 minutes in a cloud of C-616 so dense you could not see one foot in front of your face.

Subj: Combat Mask and K-25

[redacted]

Canisters were made and checked in July 1944 and used in December 1944. The test was severe. At no time did taste of "material" come through or was there any H-C-216 pungency. It was their belief (a) that all of the T was caught by the filter, probably as TO_2F_2 and (b) that the filter was as efficient in retaining H-C-216 as TO_2F_2. No T was obtained from the charcoal. C-216 was caught in almost equal parts on filter and on charcoal.

With atmospheric temperatures around 120°F., at the top of the rack of columns, the effectiveness of the canister was the same as at lower temperatures. This statement is based on short exposures to high concentrations for the short time usually encountered under such circumstances. Similarly, canisters stored for emergency use at vantage points at the top of the racks, and which were exposed to temperatures of 100° to 120°F. for many weeks were not reduced in effectiveness.

Sorry to be so late but it is hard to get extricated from Crossroads problems long enough to get at this earlier work.

Yours truly,

George M. Lyon

George M. Lyon,
Captain, MC, USNR,
Safety Advisor
Joint Crossroads Committee.

GML:mde

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