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CENTRAL INTELLIGENCE AGENCY
WASHINGTON 25, D. C.

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MEMORANDUM FOR: The Acting Director of Central Intelligence

SUBJECT : MILITARY THOUGHT (SECRET): "Chemical Warfare Weapons of the USA and the Lines Along Which They Are Being Developed", by Colonel A. Kuchin

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Richard Helms
Deputy Director (Plans)

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IN FOREIGN ARMIES

## Chemical Warfare Weapons of the USA and the Lines Along Which They Are Being Developed

by

Colonel A. Kuchin

The American imperialists, preparing intensively for a new world war, are pinning great hopes on nuclear weapons. The military command of the USA, paying particular attention to the development and stockpiling of nuclear weapon reserves, is continuing at the same time to improve other types of weapons, including chemical ones.

As is well known, chemical warfare (CW) weapons have several specific characteristics, the most valuable of which is, according to American views, that they are capable of destroying or putting out of action, personnel, and at the same time not causing damage to equipment and materiel. These characteristics can be particularly effective when an attacking force needs to preserve certain enemy installations such as his airfields, roads, bridges, combat equipment, and various types of auxiliary materials of which vast quantities are used in modern war. Relative cheapness is also considered to be a valuable quality of CW weapons.

The American imperialists, setting a high value on the effectiveness of modern CW weapons and not considering themselves bound by any kind of international agreements on their prohibition, at the present time have shown intensive activity for the further improvement and production of these weapons.

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One can judge the scope of the work being carried out by the CW Service of the US Army by the size of appropriations being made for it. Annually since 1951, 30 to 40 million dollars have been allocated to the US Department of the Army for scientific research on behalf of the CW Service. Apart from this, certain work is being carried out on the orders of the Air Force and Navy, and this work is subsidized by the departments of these branches of the armed forces. Between 1951 and 1960, about 2 billion dollars have been allocated to the CW Service.

In the current fiscal year, the sum allocated to the CW Service has been brought up to 55.3 million dollars; taking into account purchases of CW munitions, this total rises to 109 million dollars. It is envisaged that during the next five years allocations for scientific research in the sphere of CW and biological weapons will increase at least three times.

A powerful base has been built up in the USA for the production of CW weapons and CW munitions. The military-chemical industry of the USA numbers more than 100 plants. It can produce annually up to 250,000 tons of casualty-causing war gases (otravlyayushcheye veshchestvo - OV)*. Within the next few years, we should expect an increase in production of war gases as a result of other factories' starting production of new and recently developed war gases.

The USA is coordinating with Britain and Canada its work in the field of chemistry and biology for military purposes. In accordance with existing agreements, these countries regularly exchange relevant information on the results of work done and coordinate plans for the future. With such coordination, the USA is able to draw upon not only its own scientific resources but upon those of the scientists of Britain and Canada for the development of CW weapons.

* Literally "toxic agents"

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War gases at present available in the armament of the US Army are divided into six groups, according to their physiological action: nerve gases (nervno-paraliticheskoye), blood gases (obshcheyadovitoye), choking gases (udushayushcheye), blister gases (kozhno-naryvnoye), vomiting gases (rvotnoye), and tear gases.

The first four groups relate to substances which cause casualties (porazhayushcheye deystviye). In suitable doses, they can cause fatal injury to personnel. Vomiting and tear gases belong to the number of irritant substances capable of putting troops out of action temporarily.

Nerve gases ("G" code) possess the greatest toxicity, have no concealed period of action, and in certain doses cause immediate casualties. When such substances are used unexpectedly, they cause mass casualties among personnel, because even a comparatively small delay in using a gas mask can cause death or very serious aftereffects.

The most promising of this group of gases is considered to be sarin, which has high toxicity and is made from raw materials which are relatively easy to obtain.

According to American data, the average lethal inhalation dose of sarin for personnel under insignificant physical strain is approximately 0.07 $\frac{mg.min}{l}$; for personnel under considerable physical strain the dose is about 0.02 $\frac{mg.min}{l}$.

The average toxic incapacitating dose of sarin, depending on the degree of physical exertion of the personnel concerned, is approximately 0.035 to 0.015 $\frac{mg.min}{l}$.

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The Americans regard sarin as a normal issue (tabelnoye) war gas. Present industrial manufacturing resources in the USA permit the production of about 50,000 tons of this substance a year. Practically all types of CW ammunition currently available to the US armed forces can be used for sarin.

Another substance in the group of nerve gases is soman, which is two to three times more toxic than sarin. However, the production of soman is rendered difficult by the fact that the raw materials which provide its ingredients are in short supply.

The third substance of this same group is tabun. In terms of toxicity and other characteristics, it is significantly inferior to sarin and soman, and therefore production of it has now ceased.

Choking gases. In this group of war gases, the Americans regard phosgene ("CG" code) as normal issue; it is one of the most effective substances of the old type. In the opinion of the Americans, it can be usefully employed in a future war.

The toxicity of phosgene is comparatively low. The average incapacitating dose for phosgene is 1.6 $\frac{\text{mg. min}}{\ell}$; i.e., 45 times more than for sarin.

An important advantage of phosgene is the availability of a broad base for its production. Within the next few years, a considerable increase in the production of phosgene has been planned to meet industrial requirements.

Blister gases. In this group the Americans regard mustard gas ("HD" code) as normal issue. Despite the fact that mustard gas, like phosgene, belongs to the old type of war gases, it has by no means lost its military significance. This is explained by its specific effect on skin surfaces, a property not possessed either by sarin or soman. Protection

against the action of mustard gas is attended by great difficulties. Protection from the effect of mustard gas vapor is particularly complicated. The military value of mustard gas, according to American opinion, also lies in the fact that no means have yet been found of quickly curing or alleviating the effects of mustard gas. In addition, mustard gas possesses a considerably greater persistence than sarin.

The average lethal inhalation dose of mustard gas vapor, depending on the degree of physical exertion of personnel, has the value 1.5 to 0.4 $\frac{\text{mg. min.}}{l}$.

The average incapacitating dose of mustard gas vapor, acting on the cornea of the eye, consists of approximately 0.2 $\frac{\text{mg. min}}{l}$. For personnel protected by gas masks and dressed in normal clothing, the average incapacitating dose of mustard gas vapor consists of approximately 2 $\frac{\text{mg. min}}{l}$. The industry of the USA can produce about 60,000 tons of mustard gas a year.

Blood gases. Hydrogen cyanide ("AC" code) and cyanogen chloride ("SK" code) belong to this group. They have a comparatively low toxicity. The average incapacitating dose of cyanogen chloride, for example, is approximately equal to 7 $\frac{\text{mg. min}}{l}$. These war gases are regarded by the Americans as reserve issue (zapasnoye tabelnoye) war gases and are intended to fill a limited number of types of CW munitions.

Despite their relatively low toxicity, hydrogen cyanide and cyanogen chloride are considered by the Americans to be of potential combat use in a future war. For example, cyanogen chloride is considered by the Americans as a penetrating war gas, i.e., one

that under certain conditions can penetrate gas mask canisters and cause damage even to protected personnel. The industry of the USA can produce about 100,000 tons of hydrogen cyanide a year. Cyanogen chloride is obtained by the chlorination of hydrogen cyanide and can also be manufactured in large quantities.

Vomiting and tear gases. In these groups, the most important are adamsite ("DM" code), a war gas with a vomiting effect, and chloracetophenone ("CN" code), a war gas with a lachrymatory effect. Both these substances have a severe irritant action. The average incapacitating dose of adamsite is equal approximately to 0.02 $\frac{\text{mg. min}}{\ell}$ ; of chloraceto-phenone, approximately 0.08 $\frac{\text{mg. min}}{\ell}$ .

Adamsite and chloracetophenone are solid, low volatility substances and therefore are usually employed in the form of aerosols (smokes). The US Army is equipped with CW munitions filled with substances containing chloracetophenone (the formulas are known as "CNB" and "CNC" codes).

At present, preparations are being made in the USA to produce a number of new war gases, developed within the last few years. The most important of these are war gases known as "V" codes. According to their physiological action, they are similar to sarin and soman. Their distinctive feature is high inhalation toxicity and powerful skin resorption action, i.e., the ability to penetrate into a man's organism and damage him through the skin surfaces.

As we know, sarin has an appreciable skin resorption action. However, the skin resorption toxicity of sarin vapor is comparatively low. A

lethal dose of sarin vapor for personnel protected by gas masks and dressed in normal clothing is 15 mg. min./l. Absorption of a harmful dose of sarin vapor takes place slowly - during several hours. Everything points to the fact that sarin in vapor form cannot in practice be used to inflict casualties on troops protected by gas masks.

The skin resorption toxicity of the "V"-type war gases is hundreds of times higher than that of sarin. Therefore, such substances may be effectively employed to inflict casualties on troops even if they are protected by gas masks. For protection against these war gases, apart from the gas mask, special protective clothing is essential. This circumstance undoubtedly complicates to a considerable degree the problems of providing troops and the civilian population with antichemical protection.

"V"-type war gases are low-volatility liquids which can be most effectively used in the form of aerosols. Owing to their low volatility, they also apparently have high persistency on terrain in the form of liquid droplets.

Apart from the work on "V"-type war gases, much attention is being paid in the USA to the development of substances for putting personnel temporarily out of action. This work is being carried out, allegedly, with the aim of creating humane means of combat. We hear that war gases are being developed which will not cause lethal harm to personnel but will bring about a loss of combat effectiveness for a certain period, at the conclusion of which the normal functions of the organism are restored. In particular, these include war gases damaging the normal mental activity of a man, paralyzing, for example, his will to resist, making him act in a reckless manner, and causing

hallucinations or temporary paralysis.

These war gases have been named "psycho-chemical." The gas known as "LSD-25" is one of them, being a derivative of lysergic acid (lizerginovaya kislota). An industrial base is being created in the USA to manufacture such gases.

In addition to their work on psychological-action war gases, the Americans have recently made new and intensive efforts to develop powerful irritants. Among them, for example, are war gases causing severe lachrimation, coughing, vomiting, temporary blindness, etc.. We know that in the USA a war gas of such a type has been synthesized and has been given the code "CS".

CW munitions of the ground troops of the USA. In the armament of the USA there are the following types of CW munitions filled with war gases: CW shells, caliber 105, 155, and 203.2 mm; 106.7 mm mines, 115 mm CW missiles, and CW land mines (fugas). All these munitions are divided into the categories of normal issue (tabelnyy), reserve issue (zapasnoy tabelnyy), and restricted issue (ogranichenno tabelnyy). Normal issue munitions are mainly filled with sarin and mustard gas. Some CW munitions filled with phosgene and cyanogen chloride are also normal issue. However, it should be noted that newly developed CW munitions are not intended for the use of phosgene and cyanogen chloride.

A CW attack has the greatest effect when the enemy is least prepared for it. In connection with this, the Americans attach special importance to those means of disseminating war gases which permit a CW attack to be carried out unexpectedly and on a mass scale. According to American views, the main method of using war gases to inflict casualties on personnel is a surprise fire concentration, which makes it possible to create in the target area a

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combat concentration of toxic substances in 30 seconds. They assume that within this period enemy personnel will not always succeed in using their means of protection, and therefore will be put out of action. If the enemy does not have gas masks, then casualties can be inflicted on him by firing at the target with CW projectiles for a longer period of time[1]. In this case, the CW attack relies upon the effect of a total dose of toxic substance, i.e., that quantity of toxic substance which will penetrate into the organism of a man during the period that the toxic substance is active in the target area.

A CW attack relying on the effect of a total dose of toxic substance can be achieved by using considerably less ammunition than the 30-second fire concentration. In addition, it does not require massed fire, and the firing can be carried out by small artillery subunits over a long period of time.

The ground troops of the USA regard multibarreled missile mounts and also mortars as their basic means of disseminating war gases. They recommend the use of tube artillery and mortars for firing CW shells at small-scale targets located at medium ranges, because these weapons insure adequate accuracy of fire. For surprise and massed employment of war gases against targets occypying large areas and located at relatively short ranges, it is most advisable to use multibarreled missile mounts because they possess a comparatively high rate of fire and have ammunition with an optimum weight ratio of toxic substance to the total weight of the ammunition.

The capabilities of tube artillery for disseminating war gases are considerably less; they may be judged by the data in Tables 1 and 2.

1. Combat Capabilities and Employment of Toxic Chemicals. Technical Manual of the USA Army and Air Force, TM3-200/TO42C-1-2. Published by GRU of the General Staff, 1961, page 46.

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TABLE 1.

Capabilities for Inflicting Casualties on Personnel When Firing Artillery CW Shells Filled with Sarin

| Artillery system | Number of rounds fired per gun in 30 sec. | Number of guns in battery | Area of contamination (hectares) in which personnel will be put out of action in 30 sec. |
|---|---|---|---|
| 105 mm howitzer | 4 | 6 | 2 |
| 155 mm howitzer | 3 | 6 | 6 |
| 155 mm gun | 2 | 4 | 2·5 |
| 203·2mm howitzer | 1 | 4 | 2·5 |

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TABLE 2.

Capabilities for Contaminating a Locality When Firing Shells Filled with Mustard Gas.

| Artillery system | Number of rounds fired per gun in 15 mins. | Number of guns in subunit. | Area of contamination (hectares) in which personnel in gas masks will be contaminated. |
|---|---|---|---|
| 105 mm howitzer | 60 | 6 (battery) | 2 |
| 155 mm howitzer | 40 | 6 (battery) | 4·5 |
| 155 mm gun | 17 | 4 (battery) | 1 |
| 106·7mm mortar | 105 | 6 (platoon) | 8 |

Note: Data given corresponds to average meteorological conditions. The time for mustard gas to take effect is one hour.

In addition to artillery CW ammunition, the US ground troops have in their armament the CW land mine E5, which consists of the casing of the M15 heavy antitank mine filled with mustard gas.

When the land mine, which is buried 8 to 13 cm in the ground, is exploded, it produces effective contamination of the locality with liquid droplets of toxic substance to a radius of about 4 m [sic]. CW land mines are intended for use with antipersonnel mines in preparing combined fields of obstacles. The CW land mines are laid by hand or by mine layer. It is recommended that CW land mines be laid in each fifth group of a standard mine field, at the rate of one CW land mine instead of an antipersonnel mine. The CW land mines may also be reinforced by non-explosive obstacles.

CW munitions of the US Air Force. In the armament of the US Air Force there are CW aerial bombs and spray tanks (vylivnoy aviatsionnyy pribor).

CW munitions of the Air Force are intended to inflict casualties on troops and contaminate localities and objectives situated mainly in the enemy rear area.

The 10 lb M125 CW bomb is intended to disseminate nerve gases, in particular sarin. The bomb contains 1·18 kg of sarin. These bombs are dropped from an aircraft in a 1,000 lb M34 cluster bomb (kasseta) in which 76 bombs are packed.

The 1,000 lb M34 cluster bomb filled with 10 lb sarin bombs creates a lethal concentration of sarin in 30 seconds in an area of 1.56 hectares. Fighter aircraft can carry from 2 to 4 M34 cluster bombs, and bombers can carry from 4 to 40 such bombs, depending on the type of suspension.

The 115 lb CW bomb type M70 is filled with mustard gas. It contains about 27 kg of mustard gas. Fighters are capable of carrying from 2 to 6 and bombers from 25

to 72 of these bombs.

The 500 lb CW bomb AN-M78 is a modification of the 500 lb CW demolition bomb ANN-M64. The AN-M78 bomb has two fuses - nose and tail. Both fuses are percussion with instantaneous action. The bomb is filled with phosgene or cyanogen chloride. Fighters can carry from 2 to 6 and bombers from 14 to 27 bombs (depending on the type of aircraft and the construction of the bomb suspension.)

The 750 lb CW bomb MC-1, introduced into the armament of the US Air Force in 1959, is filled with sarin. It contains 100 kg of sarin. One of these bombs creates a lethal concentration of sarin in 30 seconds over an area of 0.68 hectares. Fighters can carry from 2 to 4 and bombers from 6 to 48 of these bombs.

The 1,000 lb CW bomb AM-M79 is a modification of the 1,000 lb demolition bomb AN-M65. The bomb is filled with a nonpersistent war gas. Fighters are able to carry 2, and bombers 14 to 18 of these bombs.

Airplane spray tanks (vylivnoy aviatsionnyy pribor - VAP) are intended to cause casualties to personnel and contaminate a locality and objectives with liquid droplets of toxic substances of the mustard gas and "V" types. The VAPM10 contains about 150 kg of mustard gas. The time taken to empty the VAPM10 is about 6 seconds. Airplane spray tanks may be fitted to fighters as well as to bombers. Aircraft of the B-57 type can carry 4 spray tanks, and F-84 and F-86 aircraft can carry 2 spray tanks.

The Americans advise that when using airplane spray tanks for persistent war gases of the mustard gas type, spraying should be carried out from minimum heights. The greatest effect is obtained by group dissemination of persistent war gases simultaneously from several aircraft. To inflict casualties on personnel in normal clothing, using mustard gas, it is essential to contaminate the target area with a density of 220 kg per hectare.

The dissemination from airplane spray tanks of the new "V"-type war gases, which have a considerably greater toxicity than mustard gas, is extremely effective. The minimum effective density of contamination with these gases is hundreds of times less than for mustard gas. Hence, it is understandable that when airplane spray tanks are filled with "V" gases, the capabilities of aircraft to contaminate personnel and objectives also increases considerably.

CW bombs are now considered to be the main CW weapon of the US Air Force. These bombs, filled with war gases of the sarin type, are intended to cause casualties and exhaust enemy personnel. According to American views the use of bombs filled with these gases may prove to be especially effective when carrying out a surprise attack and also in the event of poor CW discipline on the part of enemy troops. To insure surprise, the bombing attack must be carried out so that an adequate number of bombs is dropped on the target to create a combat concentration of toxic substance in 30 seconds. To inflict casualties on troops with poor CW discipline, bombing attacks may be delivered for several minutes. According to American views, it is most advisable to use aerial CW bombs to destroy targets in rear areas. It is considered that the level of CW discipline at rear objectives will always be lower than among troops who are directly in an area of combat operations.

The most effective means of inflicting casualties on personnel by means of surprise CW attack is to use bombs filled with sarin.

CW bombs filled with cyanogen chloride may be employed to inflict casualties on personnel protected by gas masks.

Aerial CW bombs filled with a war gas of the mustard gas type are intended to inflict casualties on personnel by means of vapor and liquid droplets of toxic substance, and also to deny or restrict the enemy's use

of a locality and combat equipment and to fatigue him.

Casualties can be caused by the vapor of a persistent toxic substance of the mustard gas type only in warm weather (above 4°C.) and with a wind of not more than 8 meters per second.

## Lines Along Which CW Munitions of the US Army and Air Force Are Being Developed

We have considered only those CW munitions which have already been introduced into the armament of the US Army and Air Force. Recently, in connection with the preparation and introduction into their armament of several new war gases, the Americans have paid particular attention to the development of munitions which will insure the most effective use of these war gases. For example, work is being carried out on the further improvement of artillery CW shells, in particular the 105 and 155 mm, with the aim of adapting them for use with high toxicity gases of the sarin type, and apparently of the "V"-type. Evidence of this is found in the fact that for these categories of ammunition, in addition to the nose percussion fuses, time fuses, including variable time fuses, have been made.

The most effective means of disseminating war gases are missiles, which permit surprise and massed employment of these substances to the maximum degree. In 1960, the 45-barreled rocket mount was introduced into the armament of the US Army and it was specially intended for surprise strikes, using war gases, against targets occupying large areas. With one salvo it can create a combat concentration of sarin in an area of several tens of hectares. The mount for M55 rockets is made from light aluminum alloys and can be transported on motor vehicles and helicopters.

M55 rockets can be filled with sarin and "V"-type gases. The use of the 45-barreled mount to fire rockets

filled with "V"-type gases will increase to a considerable degree the fire capabilities of these mounts. Taking into consideration the high effectiveness of the 115 mm CW rockets, in 1960 the US Congress allocated 35·5 million dollars for their production.

To exploit fully the new high toxicity war gases, it is advisable to use for their dissemination not only small-caliber rockets which are necessarily of short range, but also large-caliber missiles which can fulfil tasks of a tactical, operational-tactical, and even strategic nature.

We know that at present in the USA CW combat units are being developed for free rockets and guided missiles of the "surface-to-surface" class. CW combat units have already been formed for "Honest John" rockets and "Lacrosse" and "Corporal" missiles. CW combat units for "Little John" rockets and "Sergeant" missiles are at the stage of being worked out and are undergoing field trials; development is going on of an intercontinental cruise missile intended for the dissemination of war gases and biological agents.

The important advantage of these projectiles is that they can make simultaneous delivery to a target of a large quantity of war gases and inflict casualties over a large area. Using these projectiles, a surprise attack can be made on targets located at considerable distances, including those deep in the enemy's rear area. Taking into account the high toxicity of modern war gases, particularly of "V" type, it is possible to assume that under certain conditions some of the CW missiles and rockets of the "surface-to-surface" class will approach nuclear warheads in the scale of casualties which they will inflict on personnel.

With the appearance in the USA of a number of new war gases, the Americans have begun to pay considerable attention to the development of thermal and mechanical aerosol generators to disseminate war gases.

Aerosols of war gases, which contain both vapor of the toxic agent and very tiny particles of solid or liquid toxic agent, have a very great ability to cause casualties and can be scattered by the wind over considerable distances and can contaminate vast areas.

Various smoke equipment can be used, in principle, as aerosol generators of war gases e.g., smoke machines and several types of smoke pots. The possibility is not excluded that special highly productive aerosol generators will be made, similar to those at present being developed for spraying large forest areas with pest killers (yadokhimikat).

The material included in this article is proof of the fact that there are effective types of CW weapons in the modern offensive arsenal of the USA. At the present time, as we have already mentioned, intensive measures are being taken to develop new models of these weapons.

The appearance of war gases possessing very high toxicity, and also of powerfully acting irritants and psycho-chemical gases, has had a significant influence on the further development of the means of disseminating war gases. A particularly important trend in the creation of modern types of CW munitions is the development of CW missiles and rockets, not only for tactical, but also for operational and strategic purposes.