

# Introduction to Chemical Armament in the War Against People (the Russian's tragic experience)

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## VOLUME I. A LONG WAY TO CHEMICAL WAR

### Chapter 5. A Pre-War Soviet Chemical Weapon

*Delivery of a poison up to "the probable opponent" is separate and not the most simple kind of military art. Historically the first arm of the service where basically means of a chemical attack since times of tsar concentrated, was artillery. Besides gas cylinders of chemical commands, the army supplied also with chemical shells artillery batteries so the certain stocks artillery chemical shells have got to the Red Army from the past. In mastering by means of a chemical attack of times 1920-1930s the Red Army has done first steps at participation of officers of army of Germany. Besides artillery chemical shells and aviation chemical bombs, it there were also aircraft spray tanks (VAPs), manual portable выливаемые devices, motor vehicles for pouring chemical warfare agents, chemical land mines and many other things devices. All other chemical arms has been created by own strength under direction of native communist party.*

#### 5.1. CHEMICAL WARFARE SYSTEMS

Chemical warfare systems were always in a centre of attention the Revolutionary military council of the USSR, and from the middle 1920s he repeatedly reverted to their discussion<sup>74,76-78,93</sup>. Normally discussions came to an end acceptance on arms of new samples, and sometimes also trials<sup>77</sup>. Concerning systems of chemical arms generalising materials have been prepared many<sup>84,87,98,687</sup>. In 1930s this problem discussed already more a wide range of the supreme bodies of the power of the country<sup>89,90</sup>.

One of the first decisions the Revolutionary military council of the USSR concerning a chemical warfare was accepted on December, 14th, 1926. That day there was a decision "About injection on arms of Red Army the means of chemical attack" - the big group of chemical warfare agents, and also toxic smoke candle YaD-1<sup>76</sup>. The next big decision the Revolutionary military council on this topic ("About injection on arms of Red Army of new samples of chemical means of strife") was accepted on August, 5th, 1927 This document has entered on arms some formulas persistent chemical warfare agents and non-persistent chemical warfare agents (for filling into artillery chemical shells, aviation chemical bomb calibre 8 kg), and also NPZ – portable terrain contamination device by mustard gas<sup>78</sup>. On April, 1st, 1929 the Revolutionary military council has entered on arms a number new artillery chemical shells and aviation chemical bombs<sup>80</sup>.

Table 5.1 illustrates dynamics of injection on arms and supply of Red Army in pre-war years chemical warfare agents the basic types – non-persistent chemical warfare agents, persistent chemical warfare agents and irritants. Two subsequent tables generalise the data which are falling into to chemical arms in two natural habitats, - ground forces (table 5.2) and air (table 5.3).

**Table 5.1 Acceptance on arms of Red Army chemical warfare agents in pre-war years**

Filling	Appointment and composition	Status		
		1	2	3
<b>Non-persistent chemical warfare agents</b>				
Chlorine		+		
Chloropicrin (I)		+		
Phosgene (XIII)	Engage of live force and paralyse the enemy	+	+	+
Diphosgene (XIV)	Engage of live force and paralyse the enemy	+	+	+
Hydrogen cyanide (XV)	Engage of live force the enemy	+	+	+
<b>Persistent vesicant agents</b>				
S-Mustard (XX)	Engage of live force the enemy and terrain contamination	+		+
Lewisite (XXI)	Engage of live force the enemy and terrain contamination		+	+
N-mustard				+

<b>Irritants</b>				
Arsenic trichloride (AsCl <sub>3</sub> )		+		
Chloroacetophenone (II)	Paralyse the enemy	+	+	+
Adamsite (III)	Paralyse and emaciation of live force the enemy		+	+
Diphenylchloroarsine (IV)	Paralyse and emaciation of live force the enemy	+	+	+
Diphenylcyanoarsine (V)	Paralyse and emaciation of live force the enemy		+	
Bromobenzyl cyanide (VI)	Emaciation of live force the enemy		+	
<b>Mixtures</b>				
Mixture S-Mustard-diphosgene	50:50	+		
Formula № 1 for 76 mm artillery chemical shells short-term action	phosgene (45%), chloropicrin (45%), stannic chloride	+		
Formula № 2 for 76 mm artillery chemical shells short-term action	diphosgene (45%), chloropicrin (45%), stannic chloride	+		
Formula № 3 for 76 mm artillery chemical shells long-term action	mustard gas (90%) and AsCl <sub>3</sub>	+		
Formula № 1 for 122 mm artillery chemical shells short-term action	phosgene (50%), chloropicrin (45%), stannic chloride	+		
Formula № 2 for 122 mm artillery chemical shells short-term action	diphosgene (50%), chloropicrin (45%), stannic chloride	+		
Formula № 5 for 122 mm artillery chemical shells long-term action	mustard gas (95%) and AsCl <sub>3</sub>	+		

1 - Including in 1926-1932<sup>76,78,80,88,90</sup>; 2 - Including in 1936-1937<sup>84,98</sup>; 3 - Consideration in 1940<sup>107</sup>.

Official registration of means of a chemical attack on battle service in Red Army was a miscellaneous during the different periods of the premilitary USSR. At the first stage (in 1926-1932) to a chemical weapon with which the army has wanted to deal<sup>76,78,80,88,90</sup>, one of two categories, - "taken over on arms" (highest) and "taken over on supply" was pocketed. In 1936-1937 of so accurate categories any more was not<sup>84,98</sup>. And for the system of chemical arms surveyed in 1940, formulas became others - "taken over on arms" and "consisting on arms"<sup>107</sup>.

**Table 5.2 Dynamics of an introduction into armament of Red Army in pre-war years of ground means of a chemical attack**

Model, calibre	Filling	Status		
		1	2	3
<b>Artillery chemical shells</b>				
76 mm, № 2		+		
107 mm, № 1		+		
122 mm		+		
152 mm, № 1		+		
107 mm corps gun	Mustard gas, lewisite	+	+	+
122 mm дивизионная howitzer	Mustard gas, lewisite	+	+	+
152 mm corps howitzer	Mustard gas, lewisite	+	+	+
122 mm дивизионная howitzer	Phosgene, diphosgene	+	+	+
152 mm corps howitzer	Phosgene, diphosgene	+	+	+
165 mm chemical mine	Non-persistent chemical warfare agents			
<b>Fragmentary-chemical artillery shells</b>				
76 mm, № 10		+		
107 mm, № 2		+		
76 mm	Diphenylchloroarsine, chloroacetophenone, adamsite	+	+	+
107 mm	Diphenylchloroarsine, chloroacetophenone,	+		+

122 mm howitzer	Adamsite Diphenylchloroarsine, chloroacetophenone,	+	+	+
152 mm, gun APFK	Adamsite Diphenylchloroarsine, chloroacetophenone,	+	+	+
82 mm fragmentary-chemical mine	Adamsite		+	
<b>Portable terrain contamination devices</b>				
NPZ	Mustard gas	+		
NPZ-2		+		
<b>Battle chemical vehicles</b>				
BKhM-1		+		
BKhM-2		+		
BKhM			+	
KhT-BTT-1a			+	
Tank T-26 (KhT-26, KhT-130, KhT-138)			+	+
Chemical trailer for tanks BT				+
<b>Chemical land mines</b>				
KhF-1	Persistent chemical warfare agents	+	+	
<b>Toxic smoke candles</b>				
YaD-1	Chloroacetophenone, Diphenylchloroarsine	+		
YaM-11	Chloroacetophenone	+		
YaM-21	Adamsite	+		
YaM-31	Diphenylchloroarsine	+		
YaM			+	
YaDB-21			+	

1 - Including in 1926-1932<sup>76,78,80,88,90</sup>; 2 - Including in 1936-1937<sup>84,98</sup>; 3 - Consideration in 1940<sup>107</sup>.

Work Military Chemical Directorate of Red Army on army arms means of a chemical attack has got system character in second half 1920s<sup>87,88</sup>. Duty Military Chemical Directorate, among other, included tracing and initiation of changes in system of chemical arms of Red Army as the technics of an attack developed and industry possibilities extended. Working out of this system has begun autumn of 1928 when at the Headquarters of Red Army "the arms Commission" has been organised. This commission should develop system of all kinds of arms of the country, including chemical<sup>87</sup>. However, chemists tried to develop system of chemical arms directly in the management.

**Table 5.3 Dynamics of an introduction into armament of Red Army in pre-war years of aviation means of a chemical attack**

Model, calibre	Chemical warfare agents	Status		
		1	2	3
<b>Aircraft spray tanks (VAPs)</b>				
VAP-4		+	+	
VAP-6			+	
VAP-200			+	
VAP-250			+	+
VAP-500			+	+
VAP-1000			+	+
<b>Universal aircraft spray tanks (UKhAPs)</b>				
UKhAP-250				
UKhAP-500				
<b>Aircraft spray disposable tanks (KhARPs)</b>				
KhARP-1000				
<b>Aviation chemical bombs</b>				
8 kg	Mustard gas	+		

32 kg AKh-25, KhAB-25	Mustard gas, lewisite	+		
KhAB-200	Persistent chemical warfare agents		+	
KhAB-500	Persistent chemical warfare agents		+	
KhAB-200	Non-persistent chemical warfare agents		+	
KhAB-500	Non-persistent chemical warfare agents		+	
<b>Fragmentary-chemical aviation bombs</b>				
AOKh-8	Diphenylchloroarsine	+		
AOKh-10	Diphenylchloroarsine, adamsite	+	+	
AOKh-10				
<b>Rotating cluster aviation bombs (RRABs)</b>				
RRAB		+	+	
RRAB-250				
RRAB-500				
RRAB-1000				

1 - Including in 1926-1932<sup>76,78,80,88,90</sup>; 2 - Including in 1936-1937<sup>84,98</sup>; 3 - Consideration in 1940<sup>107</sup>.

The first **system of chemical arms of the Red Army**, approved on May, 15th, **1930**, has summed up numerous discussions and tests. One of them - winter tests of various kinds of the chemical weapon, conducted on artillery proving ground at Luga in February-March, 1930<sup>308</sup>. The system has fixed prevalence artillery chemical shells, including percussive and distant action, and also fragmentary-chemical. Was also much means of an aviation attack: aviation chemical bombs percussive and distant action, fragmentary-chemical bombs. It was provided to be armed also aircraft spray tank for dispersion liquid chemical warfare agents, the aviation ampullary device and the type plane "the chemical fighter". After decision-making filling of a theoretical set of means of chemical struggle by real samples<sup>88</sup> was necessary.

Occurrence of a chemical weapon not only at ground forces, but also at artillery and aircraft has actually generated a problem of "chemicalization" of all combat arms and kinds of armed forces. And this problem has started to be resolved, and in the beginning it occurred at lead Military Chemical Directorate<sup>85</sup>.

The second **system of chemical arms** M.N. Tukhachevskij has approved on February, 27th, **1932** after session the Revolutionary military council. The new jerk in the technician of a chemical attack, especially in connection with a conducted course on army motorisation and mechanisation has been fixed. On arms and supply many have been taken over means of a chemical attack - hydrogen cyanide, mixture mustard gas with diphosgene, chemical land mine KhF-1, toxic smoke candles YaM-31, a series fragmentary-chemical and chemical artillery shells, new aviation chemical bomb. On army supply have entered battle chemical vehicles BKhM-1 and BKhM-2, chemical mortars calibre 107 mm<sup>90</sup>. The decision the Revolutionary military council was preceded by the big tests. One of them - taktiko-technical tests in August-September, 1931 on military-chemical proving ground at Frolishchi<sup>312</sup>. Another - the big winter tests which have begun on military-chemical proving ground at Shikhany in February, 1932<sup>164</sup>. On ranges in the conditions close to a battle situation, many have passed check means of a chemical attack before their statement on arms.

At summarising of the first five-years period in the area of preparation of Red Army for an offensive chemical warfare in imperious circles of the country many achievements<sup>91</sup> have been ascertained. In particular, have been summarised all chemical warfare agents and means of conducting war which already were on army arms:

\* Chemical warfare agents: hydrogen cyanide, mustard gas, phosgene, diphosgene, formulas for fragmentary-chemical artillery shells and for toxic smoke candles on a basis adamsite, chloroacetophenone and diphenylchloroarsine;

\* Arms Chemical Troops: 107 mm mortar, battle chemical vehicles BKhM-1 and BKhM-2, portable terrain contamination device NPZ-3, chemical land mines, toxic smoke candles YaM-11, YaM-21 and YaM-31;

\* Aircraft chemical weapon: fragmentary-chemical bombs AOKh-3 and AOKh-10, aviation chemical bomb AX-25, aircraft spray tank VAP-4;

\* Artillery chemical weapon: new long-range chemical shells, fragmentary-chemical shells for 76 mm divisional gun, fragmentary-chemical artillery shells and shells in filling of liquid mustard gas for 107 mm corps gun, fragmentary-chemical and chemical artillery shells in filling of persistent chemical warfare agents and non-persistent chemical warfare agents for 122 mm and 152 mm howitzer.

**In 1933** in connection with the termination of the first five-years period and a formulation of plans for the second five-years period the Revolutionary military council has carried out the next ascertaining of achievements in military-chemical art in comparison with foreign armies<sup>687</sup>. The relation to means of a chemical attack At this time has conceptually changed. The list of priorities at application means of a

chemical attack became absolutely to others - on the first place there was an aircraft (though on arms while there were only two aviation chemical bombs and one spray device VAP-4) and only then went more equipped means of chemical attack Chemical Troops and artillery. Taking into account investigation data was considered, that at that time the Red Army was the unique army which was armed chemical tank whereas battle chemical vehicles had many countries. Reevaluation has allowed to understand also hopelessness portable terrain devices. Then it became clear, that hydrogen cyanide is one of the most effective battle agents of aircraft, and it was basic chemical difference of Red Army from other armies of the world. Accordingly, in the USSR efforts on creation of industrial base on production of hydrogen cyanide have been undertaken.

**The system of chemical arms of Red Army of 1936-1937** was a following stage in evolution of a chemical weapon<sup>84,98</sup>. Some clearness concerning its structure has occurred during numerous meetings at chief General Staff of Red Army A.I. Egorov. Especially in detail the design was discussed at meeting on October, 10-13th, 1936. On discussion on December, 9th it has been decided to include, in particular, in system big and small gas cylinders for gas releases and at the same time to pitch mortars and mines to them from Military Chemical Directorate in Artillery management<sup>99</sup>. Then it has been decided "to exclude from system of chemical arms of Red Army all means of protection from chemical warfare agents for civilians"<sup>99</sup>, that has for ever consolidated **civilians in a role of second-grade consumers means of chemical protection** (including in "a battle situation", that is on chemical weapon plants). The certain result of discussions has been brought on a January occurring of 1937. It was ascertained, that the system of chemical arms of Red Army has undergone the changes bound to changes in the military doctrine of those years - it contained already much more means of an aviation-chemical attack, than it was in the beginning 1930s<sup>99</sup>.

In 1938 three attempts of creation of more modern system of chemical arms which would be included by samples of a chemical weapon of second half 1930s have taken place<sup>104</sup>. Next year attempts have proceeded<sup>260</sup>, however absence of serious experience of use of a chemical weapon in confrontations of second half 1930s, and also features of political situation in the USSR in 1936-1938 have led to that "nobody wishes to incur responsibility" that concerned maintenances of new system of chemical arms of Red Army (so commissioner Military Chemical Directorate in the letter to the Communist party management, dated on April, 11th, 1940) qualified a state of affairs<sup>104</sup>.

Apparently, for the last time prior to the beginning Great Patriotic War the system **of chemical arms of Red Army** has been surveyed on May, 9-10th, **1940**, obviously, as a result of a dissatisfaction with attempt realisation to be prepared for a chemical stage of war with Finland. Those days in the commission of the Main military council of Red Army the developed list means of a chemical attack<sup>107</sup> was surveyed. For that moment on arms consisted 62 means of chemical arms<sup>73</sup>, to the ending of 1940 to them it was added some more<sup>107</sup>. Disputes, however, proceeded, coming to the end with rare decisions<sup>108,112</sup>.

With it the Red Army was included into the Big War.

Sea means of a chemical attack as a whole developed the same as and on a land though specificity purely sea means of an attack and purely sea feeling made itself felt. Military seamen of the USSR always so actively aspired to full independence, that else in the beginning 1920s in Leningrad there was a scientific and technical laboratory of naval department, and she was occupied with a chemical weapon. In the end 1930s at separation of military department of the USSR into army and fleet **the self-contained military-chemical system of the fleet** similar developed in army **has been framed**. The decision of Committee of defence at the government from August, 16th, 1939 had been yielded the task for the organisation for fleet of own Military-chemical management, new depots for chemical arms of the Navy (around Rybinsk and in the Far East) etc.<sup>105</sup>. Within the limits of that parallel military-chemical infrastructure it has been framed in Uglich military-chemical school of the Navy.

## **5.2. AN ARTILLERY CHEMICAL WEAPON**

From the point of view of a chemical weapon the artillery in the Red/Soviet Army always was surveyed only by an agent of maintenance of offensive operations.

In the middle 1920s, that is by the moment of formation Military Chemical Directorate, on artillery arms were only two chemical shells past years (calibre 76 mm and 152 mm) - they have been equipped in 1916-1917. Therefore at the beginning especially many forces were given to creation of numerous samples chemical munitions for available samples of artillery arms<sup>219</sup> (at the same time it was necessary to solve also a problem old artillery chemical shells with leaking and spoiling chemical warfare agents<sup>458</sup>). Active tests of samples artillery chemical shells the Soviet formation then have begun<sup>220-222</sup>.

Per 1925-1926 the artillerymen who have come in Military Chemical Directorate, have developed, besides other, even two-chamber chemical shell calibre 76 mm - a prototype of the future binary chemical weapon. "The design of this shell is calculated on creation of a cloud by mixture of two separately (an intermediate bottom) seated chemical warfare agents, at the moment of tearing up entering chemical interaction"<sup>76</sup>. In 1928-1929 on artillery and military-chemical proving grounds have been tested also artillery

chemical shells with an intermediate bottom calibre 122 mm and 152 mm. In separate chambers formulation constituents (mustard gas - 95% and arsenic trichloride - 5%)<sup>223</sup> were seated. However, then this idea in business has not gone. The real binary weapon has occurred in the Soviet Army only its last years - on a boundary 1980-1990s (in the USA it was discussed much earlier<sup>765</sup>).

For now artillerymen and chemists actively were occupied with creation all new and new samples chemical and fragmentary-chemical artillery shells<sup>221</sup>. And at the same time comparison of their battle characteristics with trophy artillery chemical shells<sup>220</sup>. In these types artillery shells there was essentially various parity of an explosive and chemical warfare agents. If in fragmentary-chemical artillery shells advantage was for BB (approximately 85% against 15% chemical warfare agent), in chemical artillery shells with non-persistent and persistent chemical warfare agents - on the contrary (5% explosive and 95% chemical warfare agents). Accordingly, also solved these shells different operational tasks.

**Fragmentary-chemical artillery shells** which possessed practically the same fragmentation action, as standard fragmentation-high-explosive shells, have been intended for firing on the live purposes - hazard to receive a fragmentation lesion it was accompanied by a serious chemical reinforcement (the enemy forced to sit in respirator)<sup>288</sup>. Accordingly, they were filled irritating chemical warfare agents - chloroacetophenone, adamsite, diphenylchloroarsine, etc.

**Chemical artillery shells**, filled with lethal chemical warfare agents, solved more a serious problem. With their use live force of the enemy should be destroyed (by shells with non-persistent chemical warfare agents, in particular with phosgene), and also the terrain contamination was provided (by shells with persistent chemical warfare agents, first of all with mustard gas)<sup>288</sup>.

Dynamics of occurrence and change artillery chemical munitions was impressing.

First it was a question of the order for 1923-1924 operational year of manufacturing in the industry of 10 thousand cases of shells, and the next year - its repetitions. It was a question about chemical and fragmentary-chemical artillery shells calibre 3 dm. Hardles was much - from incidental anybody of interaction mustard gas with the used metal to absence of an armored pit on military-chemical proving ground at Kuzminki, necessary for a carrying out of tests<sup>74</sup>. Absence in the country serious filling powers was especially acutely felt, because of what even production of the necessary volumes chemical warfare agents (and also cases munitions, fuses, etc) did not result in to occurrence of necessary quantities chemical munitions - artillery and aviation. The problem was actively discussed in the summer 1924 in mobilisation management of Red Army in connection with production plans chemical munitions on 1924-1925<sup>373</sup>.

On August, 5th, 1927 the Revolutionary military council has entered on arms artillery chemical shells calibre 76 mm and 122 mm, shells for field howitzer (formulas: chloropicrin in a mixture with phosgene or diphosgene with stannic tetrachloride addition, and also summer mustard gas with addition arsenic trichloride)<sup>78</sup>. On April, 1st, 1929 have been entered on arms new artillery chemical shells - 76 mm fragmentary-chemical shell № 10, 107 mm fragmentary-chemical shell № 2 and 107 mm chemical shell № 1 (in filling of persistent chemical warfare agents and non-persistent chemical warfare agents)<sup>80</sup>.

The first system of chemical arms of Red Army of 1930 has fixed prevalence artillery means of attacks. In a set of types artillery chemical shells, the army yet had no many of which, but wished to see on arms, shells have entered: in filling of non-persistent chemical warfare agents calibre 122 mm and 152 mm; in filling of persistent chemical warfare agents percussive action calibre 76 mm, 107 mm, 122 mm and 152 mm; in filling of persistent chemical warfare agents distant action calibre 122 mm and 152 mm; fragmentary-chemical calibre 76 mm, 107 mm, 122 mm and 152 mm. This list included also mines in filling of non-persistent chemical warfare agents, persistent chemical warfare agents and fragmentary-chemical, and, besides, chemical munitions for marine artillery<sup>88</sup>.

In the second system of 1932 the set artillery chemical means has been seriously modernised<sup>90</sup>. On arms 76 mm, 107 mm, 122 mm and 152 mm fragmentary-chemical shells in filling of adamsite, chloroacetophenone and diphenylchloroarsine, 122 mm and 152 mm chemical artillery shells in filling of non-persistent chemical warfare agents and 107 mm, 122 mm and 152 mm chemical shells in filling of persistent chemical warfare agents have been supplied. Of 76 mm chemical shell № 2 and fragmentary-chemical shells № 10, 107 mm chemical shell № 1 and 107 mm fragmentary-chemical shells № 2, and also 152 mm chemical shell № 1 have simultaneously been taken out from arms.

In 1933 when upon termination of the first five-years period summarising of military-chemical achievements has taken place, the artillery already was armed with the richest set means of a chemical attack. In particular, it possessed fragmentary-chemical artillery shells in filling of three formulas - diphenylchloroarsine, chloroacetophenone and adamsite. Besides, for it were available 122 mm and 152 mm chemical shells in filling of non-persistent chemical warfare agents and also 107 mm, 122 mm and 152 mm shells in filling of persistent chemical warfare agents. This time in number of formulas chemical warfare agents, consisting on arms, entered hydrogen cyanide, and also mixture mustard gas with diphosgene (in the ratio 50%:50%).

Let's emphasise, that by 1933 artillery commanders of any level arranged means of a chemical warfare. So, in regiment to 76 mm gun were available fragmentary-chemical shells. The divisional artillery

had already richer set means: for 76 mm gun and 152 mm mortar - shells filled with mustard gas of the raised firmness, and for 122 mm howitzer - shells filled with non-persistent chemical warfare agents and with ordinary mustard gas.

Further affairs went accruing rates so in system of chemical arms of 1936 practically there were no admissions on any types artillery chemical shells.

Chemical shells filled with persistent chemical warfare agents on a basis mustard gas and lewisite were available for 107 mm corps gun (norm of a contamination 80-100 m<sup>2</sup>), 122 mm divisional howitzer (norm 150-200 m<sup>2</sup>) and 152 mm case howitzer (norm 250-300 m<sup>2</sup>). In the industry production of these shells has been organised. With their use the terrain contamination of the enemy for the term from several hours about two days, and also a lesion of its live force was provided.

Chemical shells filled with non-persistent chemical warfare agents on a basis phosgene and diposgene were available for all howitzer - 122 mm divisional and 152 mm corps. With their use the Red Army provided to depress "fighting capability of the enemy by its forcing to be in respirator". Tactical reception has been for this purpose already fulfilled - under the favorable conditions of weather and district "creation of a gas bog". On these shells also it has been organised normal industrial production is adjusted.

Fragmentary-chemical shells have been framed for following samples of arms: 76 mm of guns - mountain, regimental and divisional, 122 mm howitzer and 152 mm gun of the Reserve of the Hirh Command. With their use it was provided to lead firing of live force "the enemy for the purpose of a irritation and neutralisation". As the chemical warfare agents it was provided to use adamsite, diphenylchloroarsine, diphenylcyanoarsine, bromobenzyl cyanide. On all types of shells industrial production already existed, on chemical warfare agents - too, behind an exception bromobenzyl cyanide on which it assumed to organise in 1937. The maintenance of chemical warfare agents in shells was not less than 15%.

By winter of 1936-1937 of a duty under the order and artillery supply by chemical shells have been pitched from Military Chemical Directorate to immediately artillerymen<sup>86</sup>.

Basic event has occurred in April, 1937 when the scientific council at Chemical Scientific Research Institute had been prepared the decision under report V.V. Aborenkov "Application and paths of development artillery chemical shells". Other system of actions has been formulated and has received a jerk. It concerned both modernisation fragmentary-chemical artillery shells, and to creation new chemical shells filled with persistent chemical warfare agents and non-persistent chemical warfare agents. Especially artillerymen have been anxious by factor of battle use of chemical warfare agents at explosion of shells (military chemists did not discuss earlier it)<sup>86</sup>. That session was remarkable two moments. On the one hand, in Military Chemical Directorate there were people of such high himiko-artillery qualification of which existence it was possible to dream only after rout of group of artillerymen led by A.A. Dzerzhkovich which have been made by efforts I.M. Fishman in 1930. On the other hand, in some days after the statement of that decision has been arrested itself I.M. Fishman.

In 1936-1937 it was supposed to adjust scale industrial productions of toxic smoke shells for 122 mm divisional howitzer.

And so proceeded on accruing to the war.

By 1940 a situation with chemical and fragmentary-chemical artillery shells it was that. The Red Army arranged chemical shells filled with persistent chemical warfare agents and non-persistent chemical warfare agents for all artillery and mortars calibre from 107 mm and more. And fragmentary-chemical shells and mines were available for all without an exception high-explosive shells and mines.

All stocks of artillery chemical shells were stored in flock artillery depots. On some depots, besides artillery, were stored also aviation chemical munitions. In many events in such depots were formed isolated aviation depots, some of which in due course became independent. In table 5.4 data about pre-war artillery depots Red Army where were stored chemical munitions including the aviation are generalised.

**Table 5.4 Pre-war Soviet artillery depots, storing chemical munitions**

Human settlement	Region	Number of depot	Formation	Capacity (waggons)
<b>East</b>				
Aga	Агинский Бурят. АО	152	1934	500
Arga	Amur oblast	32		350
Babstovo	Jewish Autonomous oblast	156	1934	500
Birobidzhan	Jewish Autonomous oblast	31		
Blagodatnoje-Horolsk	Primorski krai	77	1934	
Byrka	Chita oblast	153	1934	200
Vjatskoe-on-Amur	Khabarovsk krai	100	1934	500
Galenki	Primorski krai	89		
Zavitinsk	Amur oblast	155	1934	400
Zanadvorovka	Primorski krai	98		

Irkutsk-Batarejnjaja		41		
Knorring	Primorski krai	73	1934	500
Lesnjaja	Chita oblast	57		
Malmyz-on-Amur	Khabarovsk krai	157	1934	1500
Mohovaja Pad	Amur oblast	108		
Nerchinsk	Chita oblast	86	1934	500
Obor-Kruglikovo	Khabarovsk krai	68	1934	500
Omsk-Moskovka		94		
Partizan	Primorski krai	135	1934	400
Posjet	Primorski krai	31 (976)		
Razdolnoje	Primorski krai	85	1934	400
Retihovka	Primorski krai	493		
Solovjevsk	Chita oblast	977		
Sofijsk-on-Amur	Khabarovsk krai	33		
Sungach	Primorski krai	23		
Talovo	Primorski krai	87		
Taltzi	Buryatiya	30	1934	
Tomichi	Amur oblast	579	1939	200
Urusha	Amur oblast	154	1934	500
Ussuriisk	Primorski krai	47	1934	
Ust-Sungarijsk-Kukelevo	Jewish Autonomous oblast	82	1934- 1939	200
Halkidon	Primorski krai	159	1934	300
Khabarovsk-Krasnjaja rechka		74		
Chesnokovo-on-Amur	Amur oblast	504		
Шерловая Гора	Chita oblast	109		
<b>West</b>				
Artemovsk	Ukraine	773	1939	
Balta	Ukraine			
Balakleja	Ukraine	29		
Belichi	Ukraine	987		
Белозерье	Ukraine	443		300
Berdichev	Ukraine	442	1937	
Bronnjaja Gora	Belarus	843		
Bryansk		44		
Verhutino	Belarus	454		
Vitebsk	Belarus	616	1937	
Voznesensk	Ukraine	960		
Vyborg	Leningrad oblast	982		
Vyazma	Smolensk oblast	119		
Grechany	Ukraine	441	1937	
Grodno	Belarus	856		
Dnepropetrovsk-Suhrevka	Ukraine	620	1937	
Zhitomir-Berezovka	Ukraine	437	1937	
Zhlobin	Belarus	390	1936	
Zakopytje-Zlynovka	Belarus	65	1931	
Ivano-Frankovsk	Ukraine	831		
Kalinovka	Ukraine	439	1936	
Karachev	Bryansk oblast	28		
Kiev-Pechersk	Ukraine	64		
Kremenchug	Ukraine	27		
Krulevshizna	Belarus	275		
Kurovichi	Ukraine	832		
Levashovo-Sertolovo	Leningrad oblast	379	1936	
Lepel	Belarus	391	1937	
Lozovaja	Ukraine	718	1939	
Lvov-Kleparov	Ukraine	829		
Medvezhij Stan	Leningrad oblast	70		
Minsk-Kolodishi	Belarus	387	1937	
Mihanovichi	Belarus	582		
Nezhin	Ukraine	63		
Ovruch	Ukraine	435	1937	

Odessa	Ukraine	959		
Osipovichi	Belarus	388		
Pinsk	Belarus	847		
Polota	Belarus	69	1930	
Poltava	Ukraine	72		
Rechitsa-Kalinovichi	Belarus	392		
Roslavl	Smolensk oblast	618	1937	
Smolensk		73		
S.-Peterburg		971		
S.-Peterburg-Kushelevka		54		
S.-Peterburg-Tovarnaja		75	1931	
Uman	Ukraine	438	1936	
Urechje	Belarus	617	1937	
Cherkassy	Ukraine	830		
Chudnov-Volynskii	Ukraine	442		
Shepetovka	Ukraine	440	1937	
<b>Central, district and other depots</b>				
Aleksandrov	Vladimir oblast	65	1918	
Arsaki	Vladimir oblast	113		
Arys	Kazakhstan	42		
Baku-Nasosnaja		373	1937	
Velikie Luki-Opuhliki	Pskov oblast	615	1937	
Velikie Luki		1467		
Glotovka	Ulyanovsk oblast	738		
Kazinka	Lipetsk oblast	737	1939	
Kaluga		66		
Kotovo	Novgorod oblast	46		
Kuzhenkino	Tver oblast	39	1918	
Kungur	Perm oblast	621	1937	
Kursk		311	1918	
Kuhety	Georgia	58		
Mozhaisk	Moscow oblast	67		
Monchalovo	Tver oblast	35	1932	500
Morino	Pskov oblast	614	1937	
Moscow-Losinoostrovskaja		36		
Nahabino	Moscow oblast	38		
Novocherkassk	Rostov oblast	21		
Perm-Baharevka		59		200
Rostov-on-Don		61		
Ryibinsk	Yaroslavl oblast	34	1918	
Ryazan		35	1918	
Samara		26	1918	
Saransk-Krasnyi Uzel	Mordovia	62		
Sejima-Volodarsk	Nizhniy Novgorod oblast	53		
Serpukhov	Moscow oblast	45	1918	
Syzran	Samara oblast	22		
Tashkent	Uzbekistan	20		
Tbilisi-Navtlug	Georgia	24		
Tolmachevo-Luga	Leningrad oblast	380	1936	
Toropetz	Tver oblast	55	1914	
Ulan Bator	Mongolia	667		
Yaroslavl		71	1918	

According to ideology of 1940, the army assumed to solve with use of artillery two groups of operational tasks. First, with use persistent chemical warfare agents was scheduled to carry out terrain contamination or neutralisation fire means and live enemy forces with simultaneous terrain contamination. The expense on 1 hectares of the area: shells calibre 76 mm - 240 pieces, 122 mm - 70 pieces, 152 mm - 40 pieces Secondly, with application non-persistent chemical warfare agents were supposed to engage live forces. Thus for creation of lethal concentration of chemical warfare agents the same expense of shells (within 2 minutes) was scheduled: calibre 122 mm - 70 pieces, 152 mm - 40 pieces. It has been set in detail up in secret "Instruction on firing artillery chemical shells", approved on July, 20th, 1940<sup>225</sup>.

Artillery concerned also mortars though often special chemical units armed with them. A lot of

energy it has been spent for creation own **chemical mortar** which intended for terrain contamination (mines in filling mustard gas), emaciations of live force on the limited areas (toxic smoke mines and mines with non-persistent chemical warfare agents), and also for neutralisation live enemy forces (fragmentary-chemical mines and mines with non-persistent chemical warfare agents)<sup>288</sup>. In 1933 Chemical Troops already possessed chemical mortar calibre 107 mm the sample of 1931 (KhM-107-31). Formulas for filling of chemical mines then was a little - phosgene, mustard gas and mustard gas in a mixture with arsenic trichloride. One mine in filling of persistent chemical warfare agents contaminated the area 80 m<sup>2</sup>, a mine in filling of non-persistent chemical warfare agents framed a cloud on the area 80 m<sup>2</sup>, fragmentary-chemical the mine provided scattering of splinters with a casualty-producing effect in radius 15-20 m and irritating action chemical warfare agents in a wind direction - to 20 m, and the smoked mine formed toxic cloud in the extent to 500-600 m in a wind direction. Flying range reached to 3000 m. Simultaneously there were works on creation chemical mortars larger calibres. In particular, for 1937 have been planned manufacturing and tests of two types serious mortars - 120 mm and 160 mm. Works proceeded before the war<sup>218,285</sup>.

In the same years in army there was also a basic event - creation **chemical rocket missile** has begun. The first works have been carried out in 1934-1935 in Rocket scientific research institute (RNII). And is more narrow on May, 28th, 1936 on artillery proving ground at Sofrino (Moscow oblast) for the first time have been tested 132 mm rocket chemical mines of near action. Tearing up of the mines which have been let out from the skilled starting machine tool, has occurred at height 600 m, and their cases in the shattered condition have fallen in 500-700 m from a launch site. Further for a carrying out of tests the industry has secured an offer on manufacturing of the big parties of chemical mines First it there were mines calibre 132 mm and 250 mm though then in calibres there were changes.

In 1937 taktiko-technical requirements on rocket missile calibre 245 mm have been formulated, which intended for a destruction of manpower by creation of the big concentration of non-persistent chemical warfare agents on the big areas "by sudden discharge of the big groups of shells" (range - from 2 to 9 km)<sup>284</sup>. First rocket missiles ordinary fighters should launch, however quickly enough the development direction has sharply changed - special launching sites have been framed (future rocket barrage weapons).

Works on creation means for a volley fire rocket missiles with chemical warheads have begun in RNII in 1938. On August, 27th, 1938 engineer I.I.Gvaj has offered the design of the mobile multicharge volley equipment for firing by chemical rocket missiles. It was essentially new artillery device which allowed a volley 24 shells within several seconds to cover with a chemical cloud significant territory, then to leave a battle position. So for the first time there was an idea of creation of the mechanised equipment of a chemical attack, which the beginnings soon intensively to be embodied during a life (already without the author of the idea)<sup>766</sup>.

The first tests of chemical shells RSKh-132 have been conducted on a boundary of 1938-1939 on military-chemical proving ground at Kuzminki. The self-propelled launching site for 132 mm missiles had 24 referring on the general frame<sup>766</sup>. First 6 equipments BM-13 have been made in RNII within summer and autumn of 1940 then long tests have begun. For days prior to the beginning Great Patriotic War on June, 21st, 1941 them has examined personally J.V. Stalin. This very day the governmental order about the organisation of a batch production of rocket launching sites BM-13 and formation of rocket military units<sup>766</sup> was accepted. And during the war plant № 102 at Chapaevsk manufactured the chemical rocket missiles MKh-13 calibre 132 mm in filling of persistent chemical warfare agents, and plant № 148 at Dzerzhinsk - shells MKh-13 and MKh-31 (in the end of war) in filling of non-persistent chemical warfare agents. However, these chemical shells for reactive equipments BM-13 and BM-31 have not gone to real battle business.

### **5.3. THE CHEMICAL PORTRAIT OF LAND-FORCES**

The first system of chemical arms of Red Army of 1930 conceptually bridged ideas of the past and future<sup>88</sup>. It was supposed to apply with use of forces of special units ground forces almost all possible for that time means of a chemical attack - gas cylinders for gas releases, gas projectors, mortars, chemical land mines to dispersion persistent chemical warfare agents, toxic smoke candles (small and big). The number devices for terrain contamination included not only portable device NPZ, but also larger devices – a tank lorry and the tractor trailer<sup>103</sup>. We will survey each of these means more in detail (mortars were already discussed).

Interest to direct gas attacks was displayed at army even in the end 1920s. On its arms then there were **gas cylinders**, intending for start-up of phosgene with chlorine mixtures. Has put it was not from lungs: one type of gas cylinder in the equipped kind weighed 22,5 kg (2,2 kg phosgene and 8,8 kg chlorine), the second - 51 kg (5,6 kg phosgene and 22,4 kg chlorine). So it has not received special development<sup>287</sup>.

In the world many armies were armed also by **gas projectors**. This type of a chemical weapon was applied still in World War I. It represented a short gun tube in diameter 18-20 sm with the supporting plate. Firing it was led by mines in filling of chemical warfare agents (phosgene, diphosgene, mustard gas) on distance to 1,2 km. However works on creation Soviet gas projectors have not come to the end with anything - this kind of a chemical weapon has appeared less effective in comparison with mortars. Meeting

Scientific-Technical committee of Military Chemical Directorate, taken place on January, 29th, 1931 and devoted to means of attack of Chemical Troops, has been compelled to ascertain, that gas projectors "cannot be the basic short-range weapon neither on tactical, nor on technical properties". It has been decided "to transfer attention to working out mortars Stoks type as basic projectile weapon Chemical Troops" <sup>287</sup>.

Gas attacks were realised by application of **toxic smoke candles**<sup>212</sup>. The first candle YaD-1 (chemical warfare agents - chloroacetophenone or diphenylchloroarsine) has been taken over on arms on December, 14th 1926<sup>76</sup>. Its weight was approximately 800 g. It has held on in army not for long. Already on July, 17th, 1930 on change of this candle the following generation has come - have been taken over on arms toxic smoke candles YaM-11 (filling - chloroacetophenone) and YaM-21 (adamsite). Shortly before that they have been tested on artillery proving ground at Luga<sup>81</sup>. Production adamsite and chloroacetophenone has been organised on chemical plant № 1 at Moscow, and their filling into candles - on Bogorodskii plant № 12 at Electrostal<sup>403</sup>. The stock of toxic smoke candles was stored on depot № 136 at Ochakovo (Moscow). After the decision the Revolutionary military council from February, 27th, 1932 Chemical Troops and rifle units have started to arm also toxic smoke candles YaM-31 (diphenylchloroarsine)<sup>90</sup>. In some years in army have occurred toxic smoke candles YaM-41 (filling - diphenylcyanoarsine).

Toxic smoke candles YaM-11, YaM-21 and YaM-31 intended as for a reducing of combat value of the opponent (at conducting long battle in respirators), and for its emaciation and even for a lesion (for lack of means of protection)<sup>288</sup>. Weight of everyone candle in the equipped kind made approximately 2 kg. The white smoke which was precipitating out at burning smoke candle YaM-11, caused a dacryagogue. Candles in filling of chemical warfare agents, containing arsenic, framed greenish (YaM-21) or brownish (YaM-31) a smoke which has caused a boring of mucosas of naze and a throat. It was accompanied by tussis, a burning sensation in a breast, a nausea, sometimes vomiting. Intolerable concentration at a two-minute exposition for smoke candles YaM-11 made 0,002 mg/litre, and for YaM-21 and YaM-31 - 0,005 mg/litre. For realisation of start-up toxic smoke candles arranged the centres. Range of infiltration of a wave in a direction of a wind with irritating concentration chemical warfare agents under the favorable meteoconditions made nearby 15 km, at averages - to 10 km, and at adverse - to 5-6 km. However, these underestimated data have appeared in "the Directory on taktiko-technical properties of a chemical weapon" (Military Chemical Directorate, 1933)<sup>288</sup> only because it had only a signature stamp "secret". And here in documents with more high level of privacy ("top secret" and "top secret special importance") digits concerning range were more impressing.

This direction has received a serious jerk in 1930-1931 when Military Chemical Directorate after not so successful experiences on ordinary proving grounds has conducted two special expeditions on diffusion studying toxic smoke clouds on the big distances on "steppe open spaces": autumn - near Astrakhan<sup>311</sup>, spring - in region of Novo-Orsk<sup>313</sup>. Then battle distances of diffusion toxic smoke clouds (adamsite, chloroacetophenone) have been positioned under various conditions, and also rules of calculation of diffusion toxic smoke clouds in battle conditions are formulated. As it has appeared, during winter time toxic smoke cloud can diffuse on distances to 80 km, and this knowledge became the big secret Red Army.

For a terrain contamination persistent chemical warfare agents Chemical Troops Red Army used chemical land mines, portable terrain contamination devices (NPZ), mortars, and also battle chemical vehicles (BKHM).

The first **chemical land mines** have been tested in 1928 on the basis of model and under the guidance of military chemists of Germany (military-chemical proving ground at Shikhany). Purely Soviet tests on military-chemical proving ground at Kuzminki (April, 1930)<sup>217</sup> and on military-chemical proving ground of Moscow military district at Frolishchi (August, 1931) have then begun. In system of chemical arms of Red Army chemical land mine it has appeared in 1932 when the Revolutionary military council the decision from February, 27th has supplied on arms chemical land mine KhF which intended for "terrain contaminations persistent chemical warfare agents suddenly for the opponent"<sup>90</sup>. The chemical land mine represented the cylinder playing a role of the referring trunk, with the inserted reservoir for chemical warfare agents capacity 5 litres and charges (knocking out and explosive). Chemical land mines were instilled in land or pieces were positioned on its surface by groups till 10-20 At signal reception on wires or by radio the reservoir with chemical warfare agent was thrown out from the cylinder on height 6-12 m and contaminated the area to 300 m<sup>2</sup> (with density 20-25 g/m<sup>2</sup>)<sup>288</sup>. In the same 1932 tests chemical land mine for a contamination hydrogen cyanide and the telemechanical device for its undermining have been planned. However, chemical land mine it has appeared not so reliable to what events of summer of 1933 in Leningrad military district when a series not blown up chemical land mines should be dug out and destroyed undermining testify.

Tactical-technical requirements on new Taktical land mines two types have been formulated in 1937<sup>283</sup>. First, has been decided to begin creation chemical land mine with capacity 20 litres chemical warfare agents (first of all meant thickened mustard gas). The contamination by means of one chemical land mine the big area has been provided, not less than 1000 m<sup>2</sup> though tactics remained former -

undermining of groups chemical land mines till 10-20 piece Other type chemical land mine intended for a contamination of the closed premises which should pass to the probable opponent. In these minimises the volume chemical warfare agent was assumed small - nearly  $200 \text{ sm}^3$ .

Reverting to devices for a terrain contamination<sup>212</sup>, we will notice, that the first **portable terrain contamination devices** NPZ which intended for a terrain contamination mustard gas with use of forces Chemical Troops, it has started to be developed since 1925. It has been tested in 1926-1927 on proving grounds at Kuzminki (Moscow) and at Luga (Leningrad) and on August, 5th, 1927 is taken over on arms<sup>78</sup>. Working capacity NPZ made 8 litres, and for efflux maintenance of chemical warfare agents extension pressure was used. The contaminated area made  $800 \text{ m}^2$ . That device was not kept in troops, basically because of complexity of service. In 1930 the Revolutionary military council has armed Chemical Troops, and also regimental chemical platoons by new device NPZ-2 where extension pressure was not applied any more (device NPZ thus from arms it was not taken out)<sup>81</sup>. The new device has developed the Moscow repair artillery factory "Mastjzhart" (it was transformed to this period in plant № 67 and there was a path of development up to present "Bazalt"), and within winter and spring of 1930 it has passed tests on military-chemical proving ground at Kuzminki. Working capacity - 18 litres chemical warfare agents, weight of not equipped device - 6 kg, the contaminated area - from 600 to  $1100 \text{ m}^2$  with a bandwidth to  $2 \text{ m}^{213}$ . However, it was soon found out worthlessness also this sample, and its design should be changed. By 1933 on army arms there was device NPZ-3 with the same capacity (the manufacturer - a factory "Volcano", Leningrad). Contaminated area persistent chemical warfare agents (mainly there where there was no possibility to use BKHM) made from 200 to  $800 \text{ m}^2$  (it is the technical area of a contamination, and tactical could reach to  $3000 \text{ m}^2$ ) with a bandwidth of a contamination 2-4 m and density  $10\text{-}50 \text{ g/m}^2$ . Time of bleeding of device NPZ-3 made approximately 8 minutes, and recharge time - 4-5 minutes<sup>213</sup>.

Naturally, the army management aspired to raise efficiency of chemical subdivisions at carrying out of operations on a terrain contamination, and it encouraged transplantation chemical warfare agents on propellings - mechanical or live. The pre-production model **of the bicycle device for a contamination** was tested per 1926-1928 (quantity chemical warfare agents - 11 litres, the contaminated area -  $1200 \text{ m}^2$ , pressure - 4 atm)<sup>212</sup>. There was an attempt to frame also the motorcycle device for a contamination and even a horse carriage for contamination<sup>212</sup>. Certainly, not all these attempts 1926-1928 have gone further pre-production models, nevertheless the device in 1932 has got to army.

On a boundary 1920-1930s low-powered propellings for moving of devices of a terrain contamination began to lose gradually value, having given way to cars<sup>277</sup>, tractors and tanks. To the beginning 1930s Chemical Troops have already changed to dreams of a contamination from bicycles, motorcycles and horse carriages and have started to do it with use **battle chemical vehicles** (BKHM)<sup>282</sup>.

The first devices - car BKHM-1 and chemical tank on the basis of tank T-26 - became a work result on transfer attacking the car and the tank. As declared in 1929 I.M. Fishman, "Mechanization will consist in substantial growth of battle capacity of devices and directed by them on self-propelled chassis". The initiator of transfer of the pedestrian chemists on cars, tractors and tanks were the Revolutionary military council. So, having discussed on August, 23rd, 1931 a problem "About a condition of works on system of chemical arms", the Revolutionary military council has fixed, that "Chemical Troops are not equipped by the motorised means of a contamination". The beginning was yielded by the experiences which have been carried out on military-chemical proving ground at Shikhany still in 1928 together with German military chemists, - then the German cistern on the car for a terrain contamination persistent chemical warfare agents for the first time has been tested. Itself **vehicle BKHM-1, intending for a terrain contamination**, have tested on military-chemical proving ground at Frolishchi (Nizhniy Novgorod oblast) in 1931<sup>215</sup>. Have framed it on plant "Promet" (Leningrad) on base 1,5 tonnes triaxial lorry "Ford" (GAS AA) and intended for spreading on district of one 1 tonne persistent chemical warfare agent (battle capacity - 800 litres). Experience of acquaintance has been embodied in it with German "cistern on wheels". Anyway during tests at Frolishchi it is collateral with vehicle "Promet" the German cistern lorry "Krupp" (in absence of Germans) participated also, and German sprayers have appeared on spreading mustard gas more reliably in comparison Soviet<sup>215</sup>. Adoption BKHM-1 has taken place in 1932 the decision the Revolutionary military council within the limits of system of chemical arms. It intended for a terrain contamination persistent chemical warfare agents and supplied in independent chemical units and chemical platoons of the cavalry and mechanised units<sup>90</sup>. Characteristics<sup>288</sup>: the contamination area at one charging - 40 thousand  $\text{m}^2$ , a bandwidth - 25 m, a contamination density -  $25 \text{ g/m}^2$ .

As a whole for the test season of 1932 conducted without "German friends", enthusiasts of mechanisation of chemical art scheduled, besides BKHM-1, to test many different samples: chemical tank T-26 (capacity 500-600 litres), an chemicalizational armoured troop-carrier (capacity - 2000 litres), BKHM (capacity - 2000 litres), a chemicalizational tankette, special chemical tank for a contamination (capacity - 200 litres), BKHM on the basis of automobile FORD (capacity - 300 litres), and also railway BKHM on four-axial armour platform for creation of waves of chemical warfare agents and carryings out of operations on a contamination. That year it was supposed to carry out even military tests of tank spurt-gun for persistent chemical warfare agents. Also was scheduled to test a series of devices for transportation and overflow of

chemical warfare agents.

In March, 1934 on military-chemical proving ground at Shikhany tests of some new samples have been conducted - automobile and railway cisterns<sup>103</sup>. So, two railway cisterns have been tested for fitness to work with mustard gas (in a mixture with a benzol: spilt mustard gas "in the conditions of winter temperatures") - 50-ton and 21-ton winter-proof.

Not all plans have gone right, however progress went quickly, and is more narrow in 1934 on army arms consisted whole 4 battle chemical vehicles - BKhM-1 (automobile pouring station ARS), BKhM-2 (chemical tank on chassis BT), BKhM-3 (chemical tank on chassis T-26) and BKhM-4 (chemical tankette on chassis T-26). All these vehicles have been adapted for a terrain contamination with use persistent chemical warfare agents.

Let's note in passing singularity of birth **chemical tank** on chassis BT. When in the winter of 1933-1934 military-chemical proving ground at Kuzminki members of the government have visited, battle chemical vehicles so have liked J.V. Stalin, that he has stated "a wish to frame to XVII party congress similar vehicle, more powerful, type BT". Have framed on-stalinski prompt, though and not so quickly as the leader appealed for: communist party congress has opened on January, 26th, 1934, and production tests of the first model chemical tank BT have passed already on February, 9th. However, then it was necessary to conduct many work before he became in a battle system<sup>94</sup>.

Index of interest to the land chemical technics can serve and the statement on July, 16th, 1936 as chief Military Chemical Directorate of taktiko-technical requirements on two new battle chemical vehicles, intended for arms Chemical Troops - chemical tank KhT-29<sup>280</sup> and armour chemical car BKhA<sup>278</sup>. Chemical tank KhT-29 should provide a lesion of live force by "a spurt throwing high-speed chemical warfare agents", "discharge non-persistent chemical warfare agents in the form of gas waves or formation of fogs persistent chemical warfare agents type mustard gas", and also by "terrain contaminations in various tactical conditions by ejaculation and spraying persistent chemical warfare agents type mustard gas" (the expense - 50-60 litres/minute)<sup>280</sup>. BKhA intended for a lesion of live force with application non-persistent and persistent chemical warfare agents, and also for a terrain contamination persistent chemical warfare agents (capacity of reservoir - 1000 litres, a contamination bandwidth - 10-25 m)<sup>278</sup>.

Device BKhM-3 participated in a real battle life in larger degree, that is chemical tank T-26. It arranged the reservoir on 360 litres which was voided at operations on a terrain contamination for 2-3 minutes. The formed contamination zone persistent chemical warfare agents had length 390 m and width 25 m at density 50 g/m<sup>2</sup>. After modernisation tank T-26 has been replaced on chemical tank KhT-26 (the sample of 1938). Its tests have been conducted in 1937-1938<sup>216</sup>, and production has organised plant № 174 (Leningrad) which only in 1938 has manufactured 330 pieces<sup>107</sup>. Chemical tank BKhM-3 there has passed successful application in some battles of pre-war years, in particular on the river the Halhin-goal (Mongolia) and in Finland. However, it has been involved then on a flame throwing. On a flame throwing in Mongolia worked also chemical tanks AKhT-130.

In 1937 taktiko-technical requirements on creation new chemical tanks - on the basis of T-46 (capacity for chemical warfare agents - not less than 500 litres)<sup>281</sup> and on the basis of BT-2 (capacity - not less than 750 litres)<sup>279</sup> have been formulated. As a whole business has reached working out whole "weapons systems of chemical tank units". In May, 1938 people's commissar for defence has framed the corresponding commission, and before the war this activity was not stopped. Chemical tank BT-7 and chemical trailer to tank BT-2 have been tested in 1939 on military-chemical proving ground at Kuzminki. And within winter of 1939-1940 in Military Chemical Directorate actively discussed creation of system of chemical arms on the basis of vehicle troops. It has been decided to frame chemical tanks on the basis of one of tanks of last generation, for example T-34. For 1941 scheduled to end working out chemical armour vehicle on caterpillar to a course with capacity 1000 litres which intended for gas releases and terrain contaminations persistent chemical warfare agents (in exchange of chemical tank on the basis of BT-26).

#### **5.4. CHEMICAL TROOPS**

Chemical Troops ground forces have been separated from artillery of Red Army in second half 1920s. And till a boundary 1980-1990s there were the special chemical units intending for realisation of offensive chemical operations. Collaterally with development means of a chemical attack representations about the organisation and problems Chemical Troops and units of other combat arms in which "chemicalixation" has been conducted developed also.

Expansion of the first chemical units which have begun **Chemical Troops ground forces**, has begun in 1927. Since October, 1st, 1927 in Red Army there were two large units - 1st chemical regiment and 2nd training-experimental chemical battalion<sup>138</sup>. In September, 1928 they already participated in All-Union manoeuvres around Kiev where passed the first school of interaction with other combat arms - rifle, cavalry, aviation and searchlight. Chemical units contaminated with help the persistent chemical warfare agents approaches of rifle troops from the opponent, and also carried out "contamination in rear of the opponent at cavalry raids". Thus the balloon company has framed a motionless cloud of non-persistent

chemical warfare agents ("a gas bog"). It has allowed to conclude, that the applied kind of a chemical attack "in mobile warfare is technically possible and practically expedient"<sup>301</sup>. General conclusion I.M. Fishman was optimistical: "Taking into consideration, that Chemical Troops in the conditions of modern warfare are special and besides to one of the basic combat arms, it is necessary to organise and prepare their appropriate amount in a peace time"<sup>301</sup>.

Thoughts on special role Chemical Troops have laid down on the fertilised soil. Already in system of chemical arms of the Red Army approved on May, 15th, 1930, the high status of owners of a chemical weapon was positioned: it should concentrate at corps, army and front command<sup>88</sup>. By then Chemical Troops included already many special units: 1st chemical regiment (Moscow), 2nd separate chemical battalion, separate chemical battalion (Moscow military district, Yaroslavl), 3rd separate chemical battalion (Leningrad military district, Detskoe Seloe), 4th separate chemical battalion (Ukraine military district, Kiev-Pechersk). In the late autumn of the same year 1st chemical regiment has been translated to Yaroslavl (Moscow military district), and 2nd separate chemical battalion, accordingly, has transferred on military-chemical proving ground at Shikhany (Privolzhsky military district). Soon at Bobruisk (Belarus military district) there was 1st separate chemical battalion. In other military districts then there were less large chemical subdivisions - separate chemical companies: 1st company - in Novocherkassk (North Caucasian military district), 2nd - in Novosibirsk (Siberian military district), 3rd - in Khabarovsk (Far East Army), 4th - in Tashkent (Sredne-Asian military district), 5th - in Tbilisi (the Caucasian Red Army). In case of war these considerable chemical forces were supposed to be developed in even more significant. In particular, under the mobilisation plan of 1932 (to plan N 11) the specified really operating chemical regiments, battalions and companies has been planned to transform in 19 specialised chemical units - one separate gas projector division, 14 separate chemical battalions and 4 reserve chemical regiments<sup>138</sup>. As to efficiency of this chemical armada, in 1931 I.M. Fishman estimated it optimistically: "Chemical Troops on the basis of motorisation and mechanisation will be the cheapest way, the most economical way to apply considerable quantities chemical warfare agents".

Rearrangement and expansion of number of the special chemical units intending for problem solving of a chemical attack, went continuously all years between world wars. In particular, consecutive saturation of Red Army by technics of chemical struggle demanded not only changes of its organisation, but also number augmentation. We will specify for an example to what have come Chemical Troops as of March, 1936 when the next session of the Commission of defence Council of work and defence prepared, devoted to their reorganisation<sup>139</sup>. In table 5.5 it is cited data about number Chemical Troops for that moment.

**Table 5.5 Number Chemical Troops of Red Army as of March, 1936<sup>139</sup>**

	Chemical Troops			
	Peace time		Wartime	
	Quantity of units	Strength	Quantity of units	Strength
Chemical regiment	1	850	-	-
Reserve chemical regiment	-	-	4	12240
Separate chemical battalion	6	3860	15	15000
Separate chemical company	4	700	-	-
Reserve chemical company	-	-	1	315
Corps a chemical company	15	1515	30	6780
Chemical platoon of the fortify region	9	324	-	-
Chemical company of the fortify region	1	101	10	2240
Chemical platoon of the mechanised regiment of a cavalry division	22	330	22	330
Chemical company of the mechanised brigade	25	1200	25	1625
Chemical platoon of the tank battalion	75	1050	75	1050
Chemical platoon of the rifle-machine-gun brigade	3	45	3	78
Chemical company of the mountain-rifle division, rifle division	8	600	8	1856
Chemical platoon of the separate tank battalion	4	44	4	44
Chemical platoon of the rifle regiment, rifle	249	2639	450	11160

division				
Chemical platoon of the cavalry regiment, a cavalry division	88	2200	88	2816
Total	15458		55534	

It is visible, that chemical formations in case of war should be developed in more serious armada. It is important to mean, that this list did not include 58 chemical platoons of tank battalions of rifle divisions which have been generated shortly before it and have not been equipped yet by necessary technics. Each separate chemical battalion (into its composition entered three companies: mortar, tank and a general purpose) was armed 12 chemical mortars, 10 vehicles BKhM-1, 10 chemical tanks KhT-26 (BKhM-3) and 48 NPZ-3. Power of a battalion on a terrain contamination - 3,5 km<sup>2</sup> with density 10 g/m<sup>2</sup>, on a contamination of roads - 39 km with density 30 g/m<sup>2</sup> at a bandwidth 25 m, on the organisation toxic smoke discharge on an emaciation - 5-6 km front during 6-10 hours<sup>139</sup>. Each chemical company rifle corps (composition - three platoons) was armed 12 vehicles BKhM-1 and 60 devices NPZ-3. Its battle possibilities: on a terrain contamination - 2,25 km<sup>2</sup> two chargings with density 10 g/m<sup>2</sup>, on a contamination of roads - 26 km with density 30 g/m<sup>2</sup> at a bandwidth 25 m, on the organisation toxic smoke discharge on an emaciation - 3-4 km front during 6-10 hours<sup>139</sup>. Each chemical company of the mechanised brigade had two platoons chemical tanks KhT-26 (BKhM-3) and one platoon chemical tank KhT-27 or KhT-37 (BKhM-4). Arms: 7 chemical tanks BKhM-3 and 4 chemical tanks BKhM-4. Power on a terrain contamination persistent chemical warfare agents two chargings - 0,7 km<sup>2</sup>.

Plans of use of this armada were serious. At tactical application massive use Chemical Troops from calculation of 2-3 chemical battalions on rifle corps meant. In case of operative application of the motor-mechanised chemical troops - massed use on that operative direction where it will be decided to apply chemical warfare agents (from calculation of 2-3 chemical battalions on strengthened rifle corps or 8-10 chemical battalions on army). If necessary - realisation of the big chemical operations in army scale (creation of the big contaminated areas in hundreds km<sup>2</sup>, a gas discharge with use of the mechanised means or toxic smoke discharge from 30-40 km front, joint effects of the mechanised chemical troops with aircraft in reid, massive chemical mortar fire)<sup>139</sup>.

Outlined plans of use Chemical Troops for year of war look as apotheosis. Chemical Troops, spending for a year 75000 tonnes of mustard gas (1939 means) were able to contaminate 7500 km<sup>2</sup> or a strip with extent in total 1500 km and in depth 5 km. Application plans toxic smoke candles were so serious: with use 20 million candles Chemical Troops for a year of war could carry out 50 large toxic smoke attacks everyone at the front 50 km, in of 8 hours and with depth of penetration 50-80 km.

In 1936 the situation has matured to so serious designs, as creation of powerful formation of ground forces - chemical divisions<sup>139,140</sup> and even whole chemical corps<sup>134</sup>. And after discussion in the Commission of defence Council of work and defence all these forces of a chemical attack have started to concentrate in chemical units the Reserve of the Hirh Command.

In the summer of 1937 of discussion have proceeded<sup>141</sup>. By this time, that is in 10 years after occurrence, in Chemical Troops ground forces entered (only in composition the Reserve of the Hirh Command) many troops - 1st and 2nd motorised chemical divisions (one of them has been placed on military-chemical proving ground at Shikhany around Volsk), 25th armored brigade, 3rd and 15th separate chemical battalions and 4 separate district chemical companies (1st, 2nd, 3rd and 4th). Arms of battalions and companies - 107 mm chemical mortars, wheel BKhM and chemical tanks KhT-26. Besides it, in rifle troops also there were chemical subdivisions - 5 corps chemical mouths equipped wheel BKhM, and in 10 mountain-shooting divisions there were divisional chemical companies, armed 107 mm chemical mortars and NPZ. In four cavalry divisions there were separate chemical squadrons. The mechanised troops have not been forgotten. In everyone tank regiment of the mechanised brigades and rifle divisions and in each separate tank battalion was available on one chemical platoon (arms - three chemical tanks KhT-26 and two platform soles KhT-27). Accordingly, chemical subdivisions were available also in fortifying regions - 5 separate chemical platoons in ground forces (arms - two wheel BKhM), and also many chemical companies and platoons in fortifying regions of coastal defence.

All this chemical armada had the most powerful scientifically-test support. The chemical weapon was developed and tested in Chemical Scientific Research Institute in Moscow (with own military-chemical proving ground at Kuzminki), on central military-chemical proving ground at Shikhany (Saratov oblast), two military chemical proving grounds (in Far East Army in Razdolnoje and in Moscow military district at Frolishchi) and three test laboratories in Far East Army. Biological and toxicin weapon was framed then at Biochemical (Biotechnical) institute, and also in 3rd Special laboratory<sup>54</sup>.

Reforms proceeded up to Great Patriotic War. However it was necessary to leave dreams of creation of huge chemical combinations the Reserve of the Hirh Command because actually they led in the deadloke. Formation of the chemical corps has not taken place - even chemical divisions were not capable simultaneously forces of all regiments of a miscellaneous of a profile (tank, armoured car and mortar-jet) to solve the general problem of front. Besides chemical divisions were framed "from calculation to be armed

with tanks and armoured cars with capacity from 2 to 3 tonnes", however such technics for application chemical warfare agents has not been framed up to the war.

After I.M. Fishman has been discharged of a management military-chemical art, has begun breaking un Chemical Troops. In 1938 1st and 2nd motorised chemical divisions have been reformed in 30th (Moscow military district) and 31st (Privolzhsky military district) tanko-chemical brigades (composition - four tank batallions KhT-26), and 25th armoured brigade (Transbaikalian military district) - in 25th tank (chemical) brigade. Separate chemical batallions and companies have been transformed to separate mortar batallions (in North Caucasian military district - 5th mortar batallion, in Sredne-Asian military district - 9th, in Siberian military district - 11th, in Transbaikalian military district - 21st).

Reorganisation Chemical Troops were accompanied by augmentation of their numerical composition - the direct certificate of offensive ambitions of an army management. Calculation in General Staff, carried out in 1939, has shown growth of human composition of chemical units on 107,6%. Army so was proud of this achievement of the second five-years period, that on the pre-war XVIII communist congress people's commissar for defence K.I. Voroshilov has not forgotten to scare the West the report, that for 5 years Chemical Troops "have numerically grown twice".

The further jerk has yielded rearrangements Chemical Troops experience of two wars (successful flamethrower war - in Mongolia and not taken place chemical warfare - in Finland), and also successes in development of chemical arms - NPZ and the first chemical cars (BKHM) began to give way chemical tanks (KhT).

The letter from May, 22nd, 1940 to the Kremlin to principals of communist party (I.V.Stalin) and the government (V.M.Molotov) new people's commissar for defence S.K.Timoshenko began words: "it agree your personal directions". In that letter change of the formula of existence Chemical Troops was ascertained: "Chemical Troops now exist as a part of three separate chemical tank brigades, four separate chemical tank batallions and six mortar batallions". Forms of organisation Chemical Troops on the near future have been formulated: 1) creation 12 separate chemical batallions, capable" to carry out of a problem of active application of chemical agents "; 2) creation 14 separate batallions of anti-gas defence and one training-test batallion; 3) creation in Chemical Troops separate mortar batallions so that these special mortar units used both ordinary mines, and chemical mines, including - after reequipment - calibre 120 mm<sup>144</sup>.

After the decisions taken over in the Kremlin reform of means of chemical fight and forms of organisation Chemical Troops has been carried out. Flamethrower fire became now all-Army, instead of a chemical weapon, and it should use all. Chemical tanks and in general chemical tank subdivisions and units have ceased to be person of Chemical Troops. Chemical tank units have been disbanded, chemical mortar batallions have been renamed in mortar and pitched combined-arms command.

But offensive "chemistry" has received now the highest status of troops the Reserve of the Hirh Command. Within the limits of new organisation Chemical Troops practically in each military district by summer of 1940 have been framed separate chemical batallions as chemical units the Reserve of the Hirh Command: Leningrad military district (25th separate chemical batallion), Belarus military district, Transcaucasian military district (42nd separate chemical batallion), Kiev military district (29th separate chemical batallion, Smela; 27th separate chemical batallion, Sarny), Privolzhsky military district, Transbaikalian military district, Odessa military district (32nd separate chemical batallion, Grosulovo), and also in I Army (Far East) and in II Army (Far East). Them intended for the decision of exclusively offensive problems. The others separate chemical batallions have been organised in the autumn.

Being reverted to chemical units (separate chemical batallions and batallions of anti-gas defence), we will notice, that these names have existed not for long. The active care of maintenance of the opponent in delusion has led to that already the next order people's commissar for defense on November, 23rd, 1940 has been let out<sup>144</sup>. Offensive separate chemical batallion (chemical units the Reserve of the Hirh Command) began to name now defensive (batallions of anti-gas defence), and batallions of anti-gas defence in turn began to call decontamination batallions. For the same reason that year Chemical management of Red Army has been renamed into Management of military-chemical protection of Red Army. With this organisation and with these forces chemical units of ground forces have entered the Big War.

## **5.5. THE AIRCRAFT CHEMICAL WEAPON**

Chemical attack with aircraft use - treasured dream of very many commanders of the XX-th century. In days of World War I aviation chemical weapon was not applied. But many armies of the world are more narrow in 1923-1925 have begun intensive searches in this direction. Theorists of the future war predicted aircraft a role of the solving weapon. Italian commander Dzhulio Due according to whom the aircraft is in essence unique offensive force which should operate irrespective of army and fleet was especially active. By means of aircraft it was supposed to destroy live enemy forces and its industrial base, and also to paralyze will of inhabitants of the conquered country to resistance.

In Soviet Union aircraft involving in more active preparation to chemical warfare occurred gradually, in process of rising of its status in the army and findings of necessary technical possibilities. Still on March, 22nd, 1924 Interdepartmental meeting on chemical means of struggle, discussing works on creation of system of preparation of Red Army to offensive chemical warfare, has heard the report, that the Air-force fleet of the USSR is ready to take part in experiences on application aviation chemical bombs<sup>72</sup>. And first they really only "took part", not so hurrying up. Soon, however, a situation has changed - to the USSR there have arrived officers of German Wehrmacht (even in confidential correspondence of those years they appeared as "visitors" and "friends") and have started to solve own military-chemical problems. And at the same time - also the Soviet problems.

It is useful in this connection to recollect, what the correlation of forces in future armed conflicts saw Red Army. It is visible from the report on the plan of building of Armed forces of the USSR for 1927-1931. And so, as of April, 1927 to a management of Red Army four solving means of armed struggle saw: rifle troops with powerful artillery, a strategic cavalry, aircraft, and also chemical means<sup>126</sup>. The Marine sea fleet, on those representations, had only auxiliary value, and tanks at all have not recollected. Within the limits of this approach it is necessary to survey works which Military Chemical Directorate Red Army led at that time for maintenance of aircraft with means of a chemical attack<sup>84</sup>.

Serious impulse has been yielded closer commonwealth of "chemistry" and aircraft during the meeting which have taken place on October, 15th, 1929 at chief Military Chemical Directorate. That day representatives of military-chemical forces, including Scientific-Technical committee of Military Chemical Directorate, met delegation of management of the Air Forces. The question about aviation chemical bombs was formally surveyed, however actually the number of the reached arrangements was much more and included various organizational and technical problems. It was in essence review of all problem. The arrangement on an establishment of contact Military Chemical Directorate and its subdivisions with aviation institute CAGI and Air Academy so that they were involved in necessary aviachemical works has been reached. It has been decided to work a question on designing aircraft spray tank for planes with higher load-carrying capacity<sup>272</sup>. Accordingly, it has been decided to adapt the big planes for application available high-explosive aviation bombs big calibre (250 and 500 kg) in fragmentary-chemical equipment.

Then have agreed about reception from the Air Forces of planes with the big load-carrying capacity of type R-5/R-7 for carrying out of permanent jobs on both military-chemical proving grounds - near Moscow at Kuzminki and on Volga at Shikhany. The idea of pouring out from aircraft spray tanks persistent chemical warfare agents from small heights during winter time (that were not evaporated at flight to land) has been discussed also. At meeting the arrangement also about a formulation of minimumly necessary number of calibres aviation chemical bombs has been reached.

Already in the first **system of chemical arms** of Red Army of 1930 aviation means made a considerable part of the nomenclature of the weapon of a chemical attack. It included aviation chemical bombs percussive action (PA) in filling of non-persistent chemical warfare agents calibre 100 kg and in filling of persistent chemical warfare agents calibre 25 kg, bombs distant action (DisA) in filling of persistent chemical warfare agents calibre 100 kg, dispersing ampullary aviation bombs in filling of persistent chemical warfare agents, and also fragmentary-chemical aviation bombs calibre 10 kg. Contained in that system also aircraft spray tank<sup>88</sup>. The system included, among other, the type plane "**chemical fighter**", whose pre-production model was supposed to be framed for 5 years<sup>88</sup>. In the autumn of 1930 two managements of Red Army - the Air Forces and Military Chemical Directorate - have agreed with necessity "first of all and in the shortest term to adapt one of planes consisting on arms under chemical fighter". The candidate had been chose plane TB-1<sup>84</sup>.

Soon enough works have got serious scale. Armour attack plane LSh it was supposed to arm with four devices VAP-4 which has been taken over on arms of aircraft in the end of 1930. For 1932 was scheduled to arm aircraft spray tanks for pouring out liquid chemical warfare agents many other planes - double fighters DI-3, DI-4 and DI-6<sup>275</sup>, scout planes R-5 and R-8, sea scout planes MR-3 and MR-5, fighters I-5 and I-12, heavy attack planes TSh-2 and L-17. Then was scheduled to begin tests of the device for dispersion powdery chemical warfare agents with use plane R-5.

In 1933 in connection with the termination of the first five-years period the country leaders already considered, that "the Red Army really, actually became the first army in the world" (the order the Revolutionary military council of the USSR from December, 1st, 1933). Then achievements in military-chemical art have been ascertained<sup>887</sup>. Accordingly, the relation to means of a chemical attack has changed. **Priority** their uses became other, than earlier: on the first place there was **aviation** and only then Chemical Troops and artillery. The aircraft arms then included fragmentary-chemical aviation bombs AOKh-8 and AOKh-10, aviation chemical bomb AX-25, together with aircraft spray tank VAP-4.

To the middle 1930s aviation means a chemical attack have taken in army serious positions. Nevertheless principals of aviation and chemical managements of Red Army considered, that "the chemical arms of aircraft strongly lag behind growth and an advance in technology of the aircraft". With such thesis people's commissar for defence K.I. Voroshilov has reverted to people's commissar G.K. Ordzhonikidze in the letter referred on February, 11th, 1935<sup>95</sup>. In that letter many measures were offered: "speeding up of

works on designing of chemical arms on again under construction planes", creation of powerful "chemical" design office in aviation institute CAGI, a reconstruction of such bureau on plant № 39, and also creation "on all plane factories of design groups mainly for the equipments of chemical arms". Moreover, people's commissar for defence has asked industrial people's commissar to hear out the report about "a condition of works on designing of chemical arms of aircraft" initiators of that letter - the head of department of the Air Forces J.I. Alksnis and chief Military Chemical Directorate I.M. Fishman.

That meeting has taken place<sup>84</sup>, and it has brought basic results. On April, 4th, 1935 next decision Council of work and defence about preparation for a chemical warfare was accepted, and has been decided to equip with means of chemical arms **all** kinds of the Soviet planes<sup>95</sup>.

Serious organizational delimitation has the same year begun also. On December, 27th, 1935 the order people's commissar for defence K.I. Voroshilov the decision of problems of chemical arms of planes, including workings out of samples of arms (aircraft spray tanks, ampoule clusters) and their introductions in troops, has been passed from Military Chemical Directorate in Air Forces Management. Then transfer of all before the framed aviachemical property has taken place<sup>95</sup>.

In second half 1930s works on aircraft chemicalization have reached such level, that in Red Army have come to thought on series creation chemicalizational planes. It has been issued by decision Council of work and defence of the USSR 1936 about an intensification of chemical arms heavy and high-speed aircraft<sup>96</sup>. It was entrusted to industry to frame pre-production models of group of chemical planes - chemical attack plane SB with devices VAP-500 and UKhAP-1000, and also chemical bombers TB-3 with devices VAP-1000 and DB-3 with VAP-500. To execute these plans on July, 28th, 1936 at meeting at A.N. Tupolev (at that time it was the deputy chief of Central administrative board of the aviation industry)<sup>97</sup> demands to chemical arms of new planes have been developed (chemical attack plane SB, and also chemical bombers TB-3, DB-2 and DB-3). The new aviation technics has been intended for a affection of live enemy forces with use toxic warfare agents and ignition agents, and also for a terrain contamination with use chemical warfare agents. Equipment of planes of each type by several aviadevices of great volume for use from the big heights - VAP-500, VAP-1000, UKhAP-500 and UKhAP-1000 has been provided. Range of planes at full battle loading - from 800 km (SB, TB-3) to 1500 km (DB-3, a load 1,5 tonnes) and 3000 km (DB-2, a load 2 tonnes).

In 1936-1937 aviation institute CAGI (in it the special brigade which was occupied with "chemicalization" of planes have been organised) and plants № 145 and № 22 samples aircraft spray tanks VAP-500, VAP-1000, UKhAP-500 have framed and have tested. Batch process of planes with obligatory acquisition by their chemical devices has begun also. Samples aircraft spray tanks have started to be produced in lots: VAP-500 - in 1936, VAP-1000 - in 1937, KhARP-500 - in 1940.

These efforts have led to serious chemicalization of the Air Forces. **System of chemical arms** of the Red Army, discussed in January, 1937 at chief General Staff of Red Army A.I. Egorov, contained already much more means of an aviation-chemical attack, than in the beginning 1930s. Only aircraft spray tanks have been introduced by four models small (VAP-4M, VAP-6) and big (VAP-500 and UKhAP-500) volume which intended for arms of the big group of planes of different function - R-9, I-16, DB-3, DBA and SB<sup>235</sup>.

In June-July, 1938 on military-chemical proving ground at Shikhany military tests of chemical arms of planes DB-3 2M85, SB 2M100 (chemical attack plane) and I-15bis have been conducted<sup>234,276</sup>.

The surveyed aviation-chemical achievements would be inconceivable without progress in a development of industry. Did not forget also about perfection chemical warfare agents for filling into means of an aviation-chemical attack. So, the decision from October, 23rd, 1938 General Staff of Army has prescribed the commission on test in autumn-winter conditions aviation chemical munitions in filling of new formulas chemical warfare agents<sup>246</sup>. On results of tests numerous aviachemical complete sets "munition - chemical warfare agent" have been recommended to an adoption for use in winter conditions: KhAB-25, KhAB-200, KhAB-500 and ampoules in filling of mixture mustard gas-lewisite and mixture mustard gas-N-mustard, and also KhAB-15 in filling of viscous mustard gas. A number of formulas has been recommended for test in summer conditions. By results of the scale summer military tests which have been carried out on June, 13th of August, 1939 on military-chemical proving ground at Shikhany, have been recommended to an adoption: KhAB-25 and KhAB-500 in filling of mixture mustard gas-lewisite, nonfreezing mustard gas V.S. Zajkov, and also mixture mustard gas-N-mustard. Have taken care also of a short-term emaciation of the opponent in summer conditions. Have been for this purpose offered bombs KhAB-25 and KhAB-200 PA (filling - a solution chloroacetophenone in a dichlorethane)<sup>248</sup>.

Scale activity on aircraft "chemicalization" had penetrating sense. According to one of principals of the Air Forces of second half 1930s, in aviation arms (and its three kinds - bomber, rifle-gun and chemical - relied equivalent) the chemical weapon not simply saw closest to bomber arms, but also "development of bomber arms in purely chemical when the chemical attack will be compelled to take solving place in war was supposed".

Let's survey, further, practical problems of chemical arms of aircraft. For this purpose we will track evolution of separate kinds of a chemical weapon - bombs, spray tanks, and also cluster devices.

With creation **aviation chemical bombs** during the period between world wars very much hurried up - with purely chemical and with fragmentary-chemical. Thus, unlike artillery, in aircraft the unequivocal technical policy has prevailed far not at once. Anyway in second half 1920s both were studied of some calibres aviation chemical bombs - as a line 8, 16 and 32 kg, and line 10, 25, 100 kg which has gradually come to it in the stead (first samples AKh-25 in filling of persistent chemical warfare agents and AKh-250 in filling of non-persistent chemical warfare agents were examples of bombs of this line). Aviation bomb calibre 8 kg in filling of persistent chemical warfare agent (mustard gas with addition of 5% arsenic trichloride) it has been tested in 1926-1927 on military-chemical proving ground at Kuzminki<sup>226</sup>. In 1927 the Revolutionary military council it has been taken over by the decision on arms<sup>78</sup>, and the industry has secured an offer on party manufacturing in 6000 pieces. Simultaneously there were tests chemical bombs calibre 16 and 32 kg. The first tests bomb calibre 32 kg, intending for a terrain contamination and containing 21,5 kg persistent chemical warfare agents, have been carried out on military-chemical proving ground at Kuzminki, and military tests – on artillery proving grounds at Luga<sup>302</sup> (Leningrad military district) and Dretun<sup>306</sup> (Belarus military district). On December, 17th, 1930 it has been taken over on arms<sup>79</sup>. However on arms aviation chemical bombs calibre 8 and 32 kg were not for long – in 1932 the Revolutionary military council has taken out them from arms<sup>90</sup>.

Table 5.6 generalises data about Soviet aviation chemical bombs 1928-1938.

**Table 5.6 Pre-war chemical aviation bombs of Red Army<sup>291</sup>**

Model	Weigt, kg		Chemical warfare agents	Battle possibilities
	General	Fill		
<b>Aviation chemical bombs (KhAB)</b>				
AKh-8 AKh-10 AKh-16 AKh-32		28-30	CN CN	Quantity of splinters – to 300
AKh-80 PA		67-68	Persistent chemical warfare agents	Contamination area 620-730 m <sup>2</sup>
AKh-80 DisA		67-68	Persistent chemical warfare agents	Contamination area 1250-1300 m <sup>2</sup>
AKh-10 AKhB-25 PA	14-15	25,15	Persistent chemical warfare agents	Contamination area 520-1200 m <sup>2</sup>
KhAB -25 (AKh-25)	25		Mustard gas or mustard gas + lewisite	Contamination area 500-600 m <sup>2</sup>
KhAB-100	65		Mustard gas + lewisite	Contamination area 2000 m <sup>2</sup>
KhAB-100	45		Non-persistent chemical warfare agents	Coverage 6000-8000 m <sup>2</sup>
KhAB-200 DisA	180		Mustard gas + lewisite	Contamination area 2-2,5 hectare
KhAB-200 PA			Phosgene	Coverage 2-2,5 hectare
KhAB-200 PA			Hydrogen cyanide	Coverage 2-2,5 hectare
KhAB-500 DisA	320		Mustard gas + lewisite	Contamination area 3-5 hectare
KhAB-500 PA			Phosgene	Coverage to 3 hectare
KhAB-500 PA			Hydrogen cyanide	Coverage to 3 hectare
KhAB-1000 PA			Phosgene	

<b>Fragmentary chemical aviation bombs (AOKh)</b>				
AOKh-8	8	0,7	DA	
AOKh-10	9,56-9.78	0,69-0,79	DA	
AOKh-10			Adamsite	
AOKh-10			Mustard gas	
AOKh-15				
AOKh-25			Adamsite	
<b>Toxic smoke aviation bombs (KRAB)</b>				
KRAB-25	32	7-8	Adamsite	
KRAB-50	50	17-18	Adamsite	
KRAB-200	115	63	Adamsite	

Designations: DA - diphenylchloroarsine, CN - chloroacetophenone, PA - percussive action, DisA - distant action.

Instead of those bombs the same decision the Revolutionary military council has entered on Air Forces arms aviation chemical bombs PA calibre 25 kg in filling of mixture mustard gas-lewisite (75%:25%). Aviation bomb KhAB-25 intended for terrain contamination with the help persistent chemical warfare agents (capacity - 9,5 litres). Then in bomb the device for tearing up forestalling has been entered. As a result of it bomb it was not earthed, and it was broken off over a surface without formation of a funnel<sup>291</sup>. At bomb AKhB-25 without forestalling of tearing up the contamination area made 800-900 m<sup>2</sup>, with forestalling - to 1250 m<sup>2</sup>. Production of cases for bombs has been organised on plant at Rostov-on-Don.

Creation in the middle 1930s aviation chemical bombs large calibre (KhAB-200, KhAB-500 and KhAB-1000) in filling of non-persistent and persistent chemical warfare agents was a serious stage for Red Army. Bombs in filling of non-persistent chemical warfare agents (first of all phosgene though in 1940 has cunningly put and to hydrogen cyanide) developed in a variant percussive action and intended for a lesion of live forces. Bombs in filling of persistent chemical warfare agents (mustard gas and different mixtures mustard gas and lewisite) framed in the distant variant and they had the appointment a lesion of live forces by trickling-liquid chemical warfare agent and a terrain contamination at serial and volley bombing<sup>291</sup>. Production of cases for these aviation chemical bombs it has been organised on plant № 67 at Moscow and on plant at Taganrog. Chemical warfare agents were filled into bombs on chemical plant № 102 at Chapaevsk.

Aviation chemical bomb KhAB-200 PA in filling of phosgene was tested in 1932-1937 in three variants, depending on a thickness of walls. Reached engaging action of a wave: in 100 m from point of fracture - serious, in 200 m - an average, in 300-400 m - weak. The battle effect of a wave phosgene on the area 1,5 hectare provided effect from an easy lesion to a lesion with a lethal outcome. Bombs KhAB-200 in filling of phosgene rendered larger effect in the winter, instead of in the summer; at filling diphosgene it was received on the contrary. Norms of the expense for a lesion non-persistent chemical warfare agents: on 1 km<sup>2</sup> - 35 pieces, on 1 km front - 11 pieces<sup>291</sup>. Aviation chemical bomb KhAB-200 DisA at a height of burst 15-200 m and rates 5-7 m/sec formed the contamination area persistent chemical warfare agents to 2 hectare (width 40-90 m and length 350-400 m) at density 2,5 g/m<sup>2</sup>. It were data 1938<sup>291</sup>, however studying of possibilities KhAB-200 for winter and summer conditions has been continued also in 1940<sup>241</sup>.

Aviation chemical bomb KhAB-500 PA in filling of phosgene has been tested in 1934-1935 in winter and summer conditions on military-chemical proving ground at Shikhany. It intended for creation of the poisoned atmosphere for the purpose of a lesion of live enemy forces at wind speeds to 6 m/sec and for creation of "a gas bog" at weak winds and in the closed places (gullens, human settlements, forest). In the winter the compact cloud phosgene moved on distance 2,5-3 km, and the lesion in the poisoned atmosphere was reached: in serious degree - in 61-66% of events (experiences on animals), and easy degree - in 22-39% of events. In summer conditions the lesion area reached 29-39 hectare. Norms of expense KhAB-500 in filling of phosgene: on 1 km<sup>2</sup> - 5 bombs, on 1 km front - 7 bombs. In the end of 1935 KhAB-500 it has been introduced on arms (in filling of phosgene)<sup>84,291</sup>. Distant bomb KhAB-500 at burst at height 150-170 m contaminated the area to 4 hectare (at density 5 g/m<sup>2</sup>)<sup>291</sup>. Tests all new and new samples KhAB-500 have proceeded 1939-1940<sup>242</sup>.

After military tests aviation chemical bomb KhAB-100 PA, carried out in 1940 on military-chemical proving ground at Shikhany<sup>240</sup>, this bomb has been recommended to statement for Air Forces arms in several variants. In filling of hydrogen cyanide it intended for a lesion of troops of the enemy on open district and in shelters, and in filling of persistent chemical warfare agents - for a lesion of live forces and for a terrain contamination. We will emphasise, that the future enemy in days of Great Patriotic War has met this achievement with surprise (regarding application hydrogen cyanide)<sup>34</sup>.

Results of all these works were materialised in the decision, concerning systems of chemical arms of Red Army. By summer of 1940 the Main military council of Red Army have been left on arms aviation

chemical bombs KhAB-500 and KhAB-200 (their modernised variants - with the raised maintenance chemical warfare agents). Also it has been entered on arms aviation chemical bomb KhAB-100. And bomb KhAB-25 it has been decided not to manufacture any more though and not to take out from arms<sup>107</sup>.

In the end of December, 1940 the scale governmental decree "About maintenance of Air forces of Red Army with aviation chemical arms" has been published. It had been approved samples aviation chemical bombs on arms of the Air Forces of Red Army: KhAB-100 PA in filling of non-persistent chemical warfare agents (hydrogen cyanide) or persistent chemical warfare agents (mixture winter mustard gas V.S.Zajkov with lewisite 75%:25% on volume basis; as the reserve two more formulas persistent chemical warfare agents - mixture mustard gas with lewisite 50%:50% on volume basis, and also itself mustard gas) were surveyed; KhAB-200M PA in filling of non-persistent chemical warfare agent (phosgene) and KhAB-200M DisA in filling of persistent chemical warfare agents (mixture winter mustard gas V.S.Zajkov with lewisite 75%:25% on volume basis); KhAB-500M PA in filling of non-persistent chemical warfare agents (hydrogen cyanide and phosgene) and KhAB-500M DisA in filling of persistent chemical warfare agents (mixture winter mustard gas V.S.Zajkov with lewisite 75%:25% on volume basis); chemical ampoules (1 litre) with persistent chemical warfare agents. The same decision had been stopped production since 1941 old bombs KhAB-25, KhAB-200 and KhAB-500. It is necessary to add, that for years Great Patriotic War on plants the big parties aviation chemical bombs filled with persistent chemical warfare agents all four calibres have been made: KhAB-500, KhAB-200, KhAB-100 and KhAB-25.

Simultaneously with the chemical were developed also **fragmentary chemical aviation bombs**. Them intended for the combined lesion of the opponent chemical warfare agents irritating action (adamsite, diphenylchloroarsine) and metal splinters. The beginning has put the Revolutionary military council which in 1929 has entered on arms of Red Army fragmentary chemical aviation bomb calibre 8 kg (AOKh-8) in filling of chloroacetophenone<sup>80</sup>. It has been tested in 1928 on military-chemical proving ground at Kuzminki<sup>226</sup>. In 1930-1937 on military-chemical proving ground at Shikhany it has been tested much fragmentary chemical aviation bombs AOKh-8, AOKh-10 and AOKh-25 in filling of diphenylchloroarsine, adamsite and even mustard gas. In taken over on arms bomb AOKh-8 held 0,7 kg diphenylchloroarsine together with metal splinters (them was approximately 100). At tearing up it was formed compact grey toxic smoke cloud: on distance 100 m - width 20 m and height 10 m, and on distance 400 m - width 40 m and height 20 m. On distances to 300 m the lesion of strong and centre degree, and to 400 m - small was reached. Similar bomb AOKh-10 in filling of diphenylchloroarsine (weight chemical warfare agent from 0,69 to 0,79 kg) conceded AOKh-8 on irritating effect a little, but surpassed it in a splinter effect (number of splinters - approximately 150, their destructive force was conserved on a distance 75-100 m). It has been taken over on Air Forces arms in 1932<sup>82</sup>. Also it has been tested bomb AOKh-10 in filling of adamsite. Depth of penetration visible toxic smoke cloud - from 400 to 500 m. Bomb AOKh-25 in filling of adamsite first has not shown necessary battle properties. Nevertheless tests have been continued. Anyway in 1939 there was even an instruction on reversion with it<sup>261</sup>.

Besides chemical and fragmentary chemical bombs, in the course of working out there were also many other things types aviation bombs - rotating, smoked, gushing forth etc.<sup>231,259</sup>.

**Toxic smoke aviation bombs (KRAB)** is in essence analogues toxic smoke candles. Them intended for creation toxic smoke clouds by serial bombing from the plane in back of the opponent<sup>291</sup>. Tests KRABs have begun in 1932 on military-chemical proving ground at Shikhany. For 5 years some modifications bombs, including KRAB-25<sup>230</sup>, KRAB-50<sup>230</sup>, KRAB-200<sup>291</sup> have been tested. Cases bombs - manufacturing plant № 67, filling - on plant № 12 at Electrostal. At the heart of a smoke mixture was adamsite which production has been organised on plant № 51 (Moscow). The best battle effect has shown bomb KRAB-25 (weight toxic smoke mixtures - 7-8 kg). Covering power toxic smoke cloud was conserved to 500 m, and depth of its infiltration - 6-7 km. Toxic smoke cloud from 8 bombs on distance 250-500 m has yielded a boring of centre and weak degree of organs of breath and weak degree - an eye. Only bomb KRAB-25 could be used in rotating cluster bomb RRAB<sup>291</sup>. Summer tests KRAB-50 have been conducted in 1934 on military-chemical proving ground at Shikhany by bombing from heights to 4000 m, winter - in 1935. Weight toxic smoke mixtures - 17-18 kg. At simultaneous action 7 bombs the boring of strong degree was conserved on distance to 500 m, centre degree - to 1000 m. About necessity of adoption KRAB-50 I.M. Fishman reported people's commissar for defence in 1935<sup>84</sup>. In bomb KRAB-200 seated 63 kg toxic smoke mixtures. Depth of penetration of well visible wave from two simultaneously operating bombs reached to 3-5 km (its width on a distance 1000 m reached 100-120 m)<sup>291</sup>. Was considered, that KRABs are a powerful tool of paralyse actions of live force and hot-fire means of the opponent on distances to 5-6 km on which the irritating effect of a wave is conserved. It was supposed to combine also bombs KRABs with chemical, fragmentary chemical and high-explosive aviation bombs. Military tests KRAB-25 were scheduled for summer of 1938 and KRAB-50 - the best sample should become on arms<sup>291</sup>. Actually on arms there was charge KRAB-25YaD, however and it were in 1940 is excluded from system of chemical arms as "unsatisfactory on the taktiko-technical properties".

Simultaneously with aviation chemical bombs works on creation of a various sort **package and cluster devices** were led.

**Rotating cluster aviation bombs** (RRAB) have occurred in Red Army in the beginning 1930s. They intended for a simultaneous and mass lesion of the big areas and objects packages aviachemical and others bombs various calibres<sup>229</sup>. The first bomb RRAB the Revolutionary military council has taken into service the Air Forces on December, 11th, 1932<sup>84</sup>. In the summer of 1934 on military-chemical proving ground at Shikhany there have passed military tests of three types RRAB<sup>229</sup>. It were the devices containing the big series supplementary bombs - AOKh-8, AOKh-10, AOKh-25 and KRAB-25, etc. After dropping from plane RRABs received rotary movement during which time pulling together rings were broken off and enclosed bombs scattered in the sides. At bombing from height to 2000 m the area of a chemical lesion of one RRAB made from 7 to 11 hectare<sup>291</sup>.

Table 5.7 contains data about bombs type RRAB of pre-war years.

**Table 5.7 Rotating cluster aviation bombs<sup>291</sup>**

Model	RRAB-250	RRAB-500	RRAB-1000
Length, mm	2308	3270	3867
Swept volume, litres	301,5	628,0	1134,0
General weight, kg	67	106	160
Quantity aviation chemical bombs in one cluster:			
AOKh-8	31	100	111
AOKh-10	48	110	120
AKhB-25			20
KRAB-25		14	

Cover RRAB-500 was considered as the most effective, and the greatest battle effect was reached at filling RRAB by small fragmentary chemical aviation bombs<sup>291</sup>. Two models have been included in system of chemical arms of 1940 - RRAB-3 (RRAB-250) and RRAB-2 (RRAB-500), however, only.

The first **ampullary bombing cluster** ABK-1 intended for dropping from any height and at any rate of plane SB of circular ampoules filled with chemical warfare agents. The terrain contamination persistent chemical warfare agents, and also a lesion of live enemy forces and use persistent and non-persistent chemical warfare agents was the purpose. Serial production clusters ABK-1 has begun in 1938. Cluster ABK-3 of similar appointment has passed tests in 1940 (it intended for dropping from planes DB-3, DB-3F, etc.) . In composition clusters ABK-1 and ABK-3 circular ampoules of two types - with a diameter 125 mm (ampoule AZh-2 with volume for chemical warfare agents 0,82 litres and weight in the equipped condition 1,27 kg, its batch production has begun in 1936) and 260 mm (volume 8 litres, weight in the equipped condition 13,7 kg, tests have been carried out in 1940) were dumped. In one cluster ABK-1 30 ampoules AZh-2 (25 litres of chemical warfare agents) or 4 ampoules in diameter 260 mm (32 litres) were seated. In one cluster ABK-3 placed 120 ampoules AZh-2 (100 litres of chemical warfare agents) or 16 ampoules with a diameter 260 mm (130 litres chemical warfare agents). Besides, in 1940 ampoules with a fuse and with a diameter 113 mm (the worker capacity - 0,78 litres) have been tested. The system of chemical arms where has entered, among other, an one-litre chemical ampoule has been the same year taken over.

Except chemical bombs and clusters, from delivering of German army (and Soviet intelligence), there was an active working on by creation of **aircraft spray tanks** and **universal aircraft spray tanks** (UKhAPs)<sup>239,272,274</sup>. These metal tanks for pouring out chemical warfare agents from various heights intended for a lesion of live enemy forces persistent chemical warfare agents and non-persistent chemical warfare agents and also for terrain contamination with using persistent chemical warfare agents in liquid state. Ways of pouring out chemical warfare agents from the aviation devices were various - or free (aircraft spray tanks)<sup>272</sup> or with extension pressure (UKhAPs)<sup>239</sup>. However the path to creation of this mean of dispersion chemical warfare agents from air has appeared especially difficult.

Many armies of the world began to arm the planes aircraft spray tanks soon after termination World War I. In 1925 data about German aircraft spray tank have been received I.M. Fishman which at that time was the Soviet military attache in Germany. Becoming chief Military Chemical Directorate, I.M. Fishman has organised joint tests of German aircraft spray tank in the end of 1926 on military-chemical proving ground at Kuzminki (Moscow). They have passed successfully. New models German aircraft spray tanks also have been successfully tested in 1927-1928 at Orenburg<sup>673</sup> and at Shikhany (Saratov oblast). The German experts have given to Red Army all samples and documents on aircraft spray tanks, however designing of the Soviet models went difficultly. First copied sample VAP-1 (capacity - 80 litres non-persistent chemical warfare agent or mustard gas; the complete set from two devices intended for the equipment on scout plane R1; Pouring out height chemical warfare agents - 25-100 m) constantly yielded failures. Besides it is a lot of chemical warfare agent it was reverted on airdrome and contaminated it. The sample of 1928 VAP-2, having the same characteristics, as VAP-1, but other design of a hole for pouring out chemical warfare

agent, too was unsuccessful.

The autumn of 1929 during all-Union manoeuvres in Belarus military district had been carried out tests VAP-3 (non-persistent chemical warfare agent or mustard gas; pouring out height chemical warfare agents - 25-100 m), and they have not satisfied experts. As a whole all these models were copied by German samples, however adapted to placement on others, than German, types of planes. Besides Soviet aircraft spray tanks "it is plentiful bespatter a fuselage, planes and the plane stabilizer with chemical warfare agents". Only model VAP-4 has normally passed tests in 1930 (it was possible to find a comprehensible design of a hole for pouring out chemical warfare agent)<sup>228</sup>. And the decision on December, 17th, 1930 the Revolutionary military council has taken into service aircraft device VAP-4 intending for "hitting chemical warfare agents live enemy forces: on a march, on rest, deep in the rear, at a beaching etc."<sup>79</sup>. However tests of this device proceeded on military-chemical proving ground at Shikhany up to 1937. From low-level flight many have been tested chemical warfare agents: ordinary sulphur mustard, mixtures persistent chemical warfare agents (mustard-lewisite, mustard-propyl mustard gas, mustard-diphosgene, etc.), and also different non-persistent chemical warfare agents (phosgene, diphosgene, hydrogen cyanide). With use VAP-4 on military-chemical proving ground at Shikhany such problems, as an airdrome contamination, and also a affection of the opponent in a human settlement have been fulfilled.

Table 5.8 shows the basic models aircraft spray tanks and the devices developed in pre-war years for the Air Forces of Red Army.

**Table 5.8 Pre-war aircraft spray tanks of the Soviet Air Forces**<sup>289,290</sup>

Model	Swept volume, litres	Weight, kg		Planes	Time of discharge, sec	Serial production
		empty	equipped			
<b>Aircraft spray tanks (VAPs)</b>						
VAP-1	80	12	119,5	R-1 (2)	9	
VAP-2	80	14	107,6	R-1 (2)	7	
VAP-3	70	16	100,5	R-1 (2)	7	
VAP-4	80-85	17,6	120	R-5 (4) MBR-4 (2)	6 5-6	
VAP-5	160	38,0	238	R-5 (2)	6-7	
VAP-6:	39,5	8,65	60	I-5 (2)	3,5-4	1935
VAP-6M (VAP-50) Chemical vessel	39 350		60 455		3-4 3-5	1937
VAP-200	127	35	200	BSh-1, BSh-2	3-4	1939
VAP-500	350	100	506	TB-3 (4)	4-5	1936
VAP-1000	630	200	1040	TB-3 (2)	5-6	1937
<b>Universal aircraft spray tanks (UKhAPs)</b>						
UkhAP-250	95	100	276	BSh-1, BSh-2		
UkhAP-500	190-192	125	500	SB, DB-3...		1939
<b>Aircraft spray disposable tanks (KhARP)</b>						
KhARP-500	209	66	340	SB, DB-3	-	1940

Originally the complete set from two VAP-4 intended for arms of planes R-1 and M-5 (he allowed to contaminate persistent chemical warfare agents the area from 3 to 50 hectare from heights from 20 to 600 m with a contamination density 0,5-3,2 g/m<sup>2</sup>). On scout plane R-5 positioned on 4 devices VAP-4 (weight chemical warfare agents - 408 kg), and on MBR-4 - on 2 (weight chemical warfare agents - 204 kg). As a whole with devices VAP-4 equipped planes of assault group (R-5, MBR-2 and MBR-4, Savoy, SSS, RZ, LR, etc.), they allowed to pour out chemical warfare agents up to heights of 2000-4000 m. On VAP-5 and VAP-6 a series of devices of small volume has come to the end. Device VAP-5 had the same appointment, as VAP-4. It has appeared to checkpoints (one has been carried out test) and to a battle system has not got. And device VAP-6 of a design of a factory "Volcano" (Leningrad) has left an appreciable trace in military-chemical history of aircraft. Two VAP-6 (filling - non-persistent chemical warfare agents or mustard gas, contamination area - 1,8 hectare) provided to position at first on fighters I-5, and then and on others fighter - I-15bis<sup>276</sup>, I-16P, I-153<sup>255</sup> and others.

Series creation aircraft spray tanks (VAPs), UKhAPs and KhARPs big capacity, assumed to the equipment on heavy chemical planes, became the following stage in chemical arms of aircraft. These devices already considered that level which was reached by an anti-aircraft artillery in world armies in the middle 1930s - for carrying out of chemical attacks it was necessary to leave on the big heights. Besides

these devices allowed to spend more economically chemical warfare agents: use efficiency chemical warfare agents at devices (at VAP-500 - 82 %, at KhARP-500 - 81,9 %, at UKhAP-500 - 72,4 %) was above, than at aviation chemical bombs KhAB-500 (62 %).

The first tests of devices VAP-500 have been carried out on military-chemical proving ground at Shikhany in 1935-1936. Pourings out mustard gas from height 500 m "have yielded valuable results and have quite allowed to draw a conclusion on toxic efficiency mustard gas in these conditions". Following experiment has taken place in September, 1937. Within the limits of that experiment 1200 kg mustard gas have been poured out in the field on proving ground at Shikhany from height 200 m with use plane DB-3 (the contaminated area - 40,7 hectare, a contamination density - 11,6-12,4 g/m<sup>2</sup>). 15 dogs have been poisoned all, and 9 from them were lost, and the others have received a serious poisoning. On results of tests it has been decided to position the complete set from 4 devices VAP-500 on bombers TB-3. With them were equipped also DB-2, SB, DB-3 and other planes. By means of VAP-500 was scheduled to carry out pouring out persistent chemical warfare agents from battle heights (5-8 km) for the purpose of a contamination of the big areas for an emaciation of the opponent. At mass application persistent chemical warfare agents from the big heights founders VAP-500 hoped to provide the combined lesion of live enemy forces (directly from trickling-liquid chemical warfare agents, and also from contact to contaminated district). At pouring out mustard gas from VAP-500 the Soviet commanders have received the results which have encouraged them: a skin lesion in 100% of events, a lesion of eyes - in 46%, a lesion of organs of breath - in 25%. Development VAP-500 has been continued and after the beginning of its batch production<sup>256,257</sup>.

Device VAP-1000 had the same appointment, as VAP-500. It also assumed to position on chemical bombers TB-3, DB-2, etc. In case of pouring out 810 kg mustard gas from height 700 m the contamination 80 hectare was provided. The transition type device VAP-200 has been tested also. The first tests on range of all-purpose instrument UKhAP-500 of working out of aviation institute CAGI, pouring out chemical warfare agents from which was provided with a powder pressure (8-12 atmospheres), have begun in 1935. Military tests have come to the end in 1939<sup>239</sup>. The device intended for a lesion of live enemy forces and a terrain contamination. By it have been armed attack planes and bombers SB, DB-3, MBR-6, etc. And in 1940 device UKhAP-250 (for arms of planes BSh-1, BSh-2, MBR-2, etc.) has been tested.

In second half 1930s there was a question on **a division of labour of the plane and chemical spray tanks**. Heavy and the high-speed planes superseded on the big heights because of successes of an antiaircraft artillery, actually could not carry out aim waterings chemical warfare agents any more. As consequence, it was necessary to transfer on spray chemical devices ideology of application chemical munitions distant action - bombs and shells. Within the limits of this ideology the plane should continue to operate at the big heights and the big rates, and chemical attack could come true with use of thrown off devices: they should be opened at optimum height and carry out a chemical attack irrespective of the plane. Thus, aircraft chemical spray tanks became same one-trip, as chemical bombs and chemical shells.

In practical work on designing spray chemical tanks the one-time use, intending for a lesion from high-speed planes of live enemy forces persistent and non-persistent chemical warfare agents, and also terrain contaminations persistent chemical warfare agents, competition was developed. On arena there were chemical aviation disposable devices of type KhARP<sup>273</sup> designs plant № 145, and also distant chemical devices of a design of aviation institute CAGI.

Device KhARP-500 could be dumped from the plane from the big heights, and its opening under the influence of powder gases should occur at the height convenient for chemical attack. This device has been tested for the first time in 1938 and it has shown "reliable action and satisfactory battle effect with persistent chemical warfare agents for a lesion of live force". Tests of 1939 on military-chemical proving ground at Shikhany have led to the conclusion, that it can be recommended to military tests in filling of the cotton tampons permeated persistent chemical warfare agents. The device was positioned on chemical attack planes and on bombers (SB, DB-3, etc.)<sup>243</sup>.

It is necessary to add, that from the richest variety of models aircraft spray tanks in system of chemical arms of 1940 the most effective have got only - VAP-500, VAP-200 and VAP-6, already standing on arms, and also UKhAP<sup>239</sup> which should be entered on arms of the Air Forces of Red Army.

In connection with creation spray tanks for great volumes chemical warfare agents especially it is necessary to mention old dream of command of Red Army to learn **to apply chemical warfare agents from the big heights**, that is in essence to learn an aviation-chemical attack from an ambush. Still on December, 19th, 1931 in the decision the Revolutionary military council "About an invention condition" it has been decided "to reach in 1932 of dispersion liquid chemical warfare agents from height 5000 m"<sup>204</sup>. And then such decisions were taken over repeatedly, however conditions for their realisation have ripened not at once. The dream of high-rise pourings out chemical warfare agents has been realised by autumn of 1938 when under the decision of Committee of defence at the government in Sredne-Asian military district have been conducted special aviation-chemical exercise on application of new ways of an aviation chemical attack<sup>349</sup>. Exercise have taken place between October, 11th and on November, 10th, 1938 in Hungry steppe on border of Uzbekistan and Kazakhstan<sup>350</sup>.

Experiments on pouring out persistent chemical warfare agents from very big heights were

conducted by three planes DB-3, armed three VAP-500 everyone, and two planes TB-3 RN, armed three VAP-1000 everyone. In total 15 experiences on pouring out of various formulas persistent chemical warfare agents (mustard gas, mixtures mustard gas with a dichlorethane, and also mixtures mustard gas with lewisite) from heights 2000, 4000, 5000, 6000, 7000 and 7600 m have been carried out. A conclusion of organizers of exercise: "... It is proved, that high-rise pourings out are one of powerful ways of an air-chemical attack. At high-rise pourings out persistent chemical warfare agents the contamination of the vastest areas measured in tens of square kilometres (10-25 km for link DB-3) is reached"<sup>350</sup>.

Possibility to engage the big areas from heights 5-8 km very much imposed Air Forces command. Anyway problems on working off of operational and tactical application persistent chemical warfare agents from the big heights have been yielded in 1939 to aviation forces of all military districts of the country<sup>246</sup>.

The next jerk to development of means of a chemical attack in aircraft was yielded by the decision of the Military council of the Air Forces of Red Army from January, 31st, 1939 about a raising of level of chemical preparation of the Air Forces<sup>135</sup>. It was ordered, that taktiko-technical requirements on **all new military planes** necessarily joined chemical arms, and tests of new planes have been decided to conduct simultaneously with test of their chemical arms. It has been decided also, that half of planes of the country (assault, military, light-bombardment) should be armed chemical aircraft spray tanks. The same document has been decided to appeal for General Staff Red Army to solve a question on fastening to the Air Forces of a site of land 80x80 km<sup>2</sup> for creation special Aviation chemical proving ground for carrying out of experiences and manoeuvres on application chemical warfare agents with use of aircraft from any heights under any meteoconditions (pourings out persistent chemical warfare agents from the big heights, bombing aviation chemical bombs the big calibre from heights more than 500 m, emissions of waves non-persistent chemical warfare agents, training-combat preparation of chemicalizational aviation regiments)<sup>135</sup>. The idea has been realised quickly<sup>172</sup>, and scale aviation-chemical manoeuvres on again opened around Uralsk (Kazakhstan) proving ground have taken place between August, 5th and on September, 28th, 1940. Participants - "chemical" air regiments (16th, 48th and 50th). Experiences on application persistent chemical warfare agents included bombing KhAB-200, pouring out from height 6000 m etc<sup>359</sup>.

In general prior to the beginning of the Big War the Soviet chemical weapon is strong "has laid down on a wing"<sup>260</sup>.

Dream L.D. Trotskij about crossing of chemistry with aircraft came true actively. Baptism of fire **chemicalizational aviation units** has taken place in the autumn of 1928 during All-Union manoeuvres around Kiev. On September, 12th the group as a part of 5 planes chemicalizational squadrons of 5th aviation brigade "has carried out raid on territory of station Kiev-passenger (depot, the main workshops and station)". In the report which has been prepared by results of that raid, head Military Chemical Directorate was optimistical: "The great value of dispersion mustard gas from planes as powerful tool for drawing of immediate losses to troops was completely be confirmed"<sup>301</sup>. In 1931 I.M. Fishman declared, that "the question of chemicalization of air fleet is put forward on the first place". And it actively operated. According to the reference book of 1931, power of an assault squadron of planes R-5 (arms - devices VAP-4) was that. It could engage a column of the opponent with extent 3 km and width of order 500 m at middlr density of persistent chemical warfare agents 10 g/m<sup>2</sup> or length 6 km and width 500 m at density 5 g/m<sup>2</sup>. Two such squadrons could be applied to a lesion of battle orders of a rifle division (a lesion total area - 3 km<sup>2</sup> at density persistent chemical warfare agents 10 g/m<sup>2</sup> or 6 km<sup>2</sup> at density 5 g/m<sup>2</sup>). And the squadron of light bombers could deliver for one start 19,5 tonnes bombs AKh-25, having provided a lesion 0,5 km<sup>2</sup> at density persistent chemical warfare agents approximately 15 g/m<sup>2</sup>.

Formation and rearrangement aviation chemicalizational units went continuously, and it has been bound to active development of a chemical weapon of aircraft. Occurrence of an aviachemical striking force is bound to the guideline of chief General Staff of Red Army A.I. Egorov from March, 23rd, 1936 about allocation as a part of the Air Forces of group of aviation brigades, specialised on chemical weapon use - 109th assault aviation brigades (Chita), 44th assault (Krasnoyarsk), 100th assault (Detskoe Selo), 81st assault (Kiev), 114th assault (Gomel), 16th heavy (Poltava) and 19th heavy (Ivanovo). On August, 5th, 1938 there was a next guideline of chief General Staff on allocation of new assault and bomber aviation regiments for chemical weapon application (pouring out persistent chemical warfare agents and non-persistent chemical warfare agents from aircraft spray tanks, ampoule-throwing and bombings aviation chemical bombs). In November, 1939 General Staff has defined 10 more assault and bomber air regiments "in quality chemicalizational for fulfilment of special chemical problems and acquisition of practical skills on chemical weapon application"<sup>246</sup>.

Respective alterations occurred in training system in aircraft. In 1936 4 chemicalizational assault aviation brigades (81st, 100th, 109th and 114th) have mastered high-rise pouring out chemical warfare agents.

On a boundary of 1936-1937 the role of chemical arms of aircraft has increased so, that it began to consider not tactical, but **the operative factor**. Estimations of chemical preparation of the Air Forces of Red Army have been carried out also<sup>334</sup>. For 1937 people's commissar for defence has set for all Air Forces a problem that chemical preparation became one of principal views of special preparation. In particular, it was

offered to bomber aircraft to learn application art chemical warfare agents from the big heights. To execute it 10% of starts on flying-tactical manoeuvres with application of a chemical weapon were ordered to conduct the Air Forces<sup>338</sup>. The instruction on preparation of airdromes to a start of planes with aircraft spray tanks has been developed<sup>341</sup>. And in the end of 1937 in the Air Forces have summed up chemical preparation<sup>335</sup>. Numerous chemicalizational air regiments have received for 1939 a wide range of problems on mastering by tactics and technics of application of all kinds of a chemical weapon of aircraft at any heights (pouring out persistent and non-persistent chemical warfare agents from aircraft spray tanks, ampoule-throwing, bombing). Besides, it was recommended "to learn application chemical warfare agents on air targets"<sup>246</sup>. Nevertheless the aircraft management has not been satisfied by a state of affairs. In this connection in the order of the chief of the Air Forces of Red Army from June, 15th, 1940 backlog of aviation units in chemical preparation has been again noted<sup>363</sup>. As a negative example it has been specified, that before a beginning of war with Finland aviation units have arrived on front without a chemical weapon.

Development of aviation technics of a chemical attack, successes of military exercises and tests in 1938-1940 were accompanied by **rising of the status of military-chemical service in aircraft**. It has been reflected in "Position about an Air Force Staff of Red Army", approved on September, 10th, 1940. Among the basic departments without which any headquarters does not manage, it has appeared also... chemical. The chief of department of chemical service of an Air Force Staff simultaneously became the chief of chemical service of the Air Forces of Red Army. Serious problems have been assigned to the recreated department: system engineering of chemical arms and problems of battle application means of chemical attack, participation in carrying out of military tests of samples of chemical arms and carrying out of experimental exercises on chemical weapon application, a management of preparation of special chemical units of the Air Forces, participation in working out of new samples means of chemical attack and means of protection..

Gravity of the developed status of a chemical weapon in the Air Forces it is especially convex it was displayed in P.F.Zhigarev's order - the commanding Air Forces of one of armies in the Far East. This order has been signed on July, 27th, 1939 after the corresponding guideline from Moscow. It was offered to all units of the Air Forces of army "at fulfilment of exercises in air to be guided by following norms of arms a chemical weapon": fighter aviation - 5%, army and distant bomber - 10%, near bomber - 20%, assault - 30%.

Let's not err – those percent were not A.F.Zhigareva's personal initiative, and a consequence of the general tendency. In acknowledgement we will specify, with what digits the chief of the Air Forces of Red Army A.D.Loktionov operated, when introducing in 1939 to chief General Staff B.M.Shaposhnikov "Mobilization demand" the Air Forces of Red Army on chemical warfare agents and arms on norms of a wartime<sup>110</sup>. The aircraft scheduled to use within a year of war a lot of chemical means: 60000 tonnes persistent chemical warfare agents and 18000 tonnes non-persistent chemical warfare agents. The number of starts with aircraft spray tanks planes of chemicalizational aviation units was thus scheduled so: for bombers DB-3 - 75% from total number of starts, for attack planes BB-2, I-153 and I-180 - on 62%. And it was not an exception - arms (non-chemicalizational) aviation units scheduled to use a chemical weapon so actively: The number of starts with aircraft spray tanks at light bombers SB and near bombers BB-22 should make not less than 20% from total number of starts, at attack planes I-153 - not less than 30%, at fighters I-153 and I-180 - not less than 10%, bombers TB-7 and DB-3 - not less than 10%<sup>110</sup>. In the end of 1938 business has reached an establishment of norms of arms of new planes chemical devices so that planes were equipped aircraft spray tanks already at the moment of their production on aviation plants<sup>246</sup>. Digits were received by the impressive: heavy, centre and distant bombers there should on 1/3 be adapted under application aircraft spray tanks, light bombers and planes of arm aircraft - half, attack planes and fighters - on 1/5.

Orders of the Soviet military minister from February, 15th, 1939 - absolutely secret order № 007<sup>101</sup> and the secret order № 023<sup>102</sup> (two orders because the reader at them had different degree of "admission" to secrets) became **a result** of that activity on preparation for an aviation chemical attack. In them K.I. Voroshilov has listed all types of available planes and types of a chemical weapon which could be applied with their help. It is necessary to emphasise, that the order 1939<sup>101</sup> was seriously enriched in comparison with the similar document 1936<sup>100</sup>.

Let's cite these data that it was possible to estimate scale reached (the minimum height for application of all chemical and fragmentary chemical aviation bombs was same - 300 m for the targets on land and on water):

\* heavy bomber TB-3 arranged a bombing load in 2000 kg and could apply 26 chemical bombs KhAB-25 (filling – persistent chemical warfare agents), or 26 smoked aviation chemical bombs KRAB-25YaD, or 4 bombs KhAB-200 (filling – persistent or non-persistent chemical warfare agents), or 4 bombs KhAB-500 (non-persistent chemical warfare agents)<sup>251</sup>;

\* distant bomber DB-3 had a bombing load 1000 kg and could move 10 bombs KhAB-25, or 10 bombs KRAB-25YaD, or 3 bombs KhAB-200, or 3 bombs KhAB-500<sup>236,251,252</sup>;

\* middle bomber SB-2M-100 with a bombing load 600 kg could carry 6 bombs KhAB-25, or 6 bombs KRAB-

25YaD, or 24 fragmentary chemical aviation bombs AOKh-8 (in a kind cluster), or 24 aviation bombs AOKh-10 (in a kind cluster)<sup>233,253</sup>;

\* middle bomber SB-2M-100 (modernised) with a load 600 kg could carry 2 bombs KhAB-200 or 2 bombs KhAB-500<sup>233,253</sup>;

\* Heavy bomber TB-1 with a bombing load 1000 kg could transfer 6 bombs KhAB-200;

\* scout plane R-5 had a bombing load 300-500 kg and could transfer 8 bombs AOKh-8, or 8 bombs AOKh-10, or 8 bombs KhAB-25, or 8 bombs KRAB-25YaD, or 2 bombs KhAB-200;

\* scout plane R-6 had a bombing load 192 kg and could transfer 6 bombs AOKh-8, or 6 bombs AOKh-10, or 4 bombs KhAB-25, or 4 bombs KRAB-25YaD;

\* plane R-zet had a bombing load 300-500 kg and could transfer 8 bombs AOKh-8, or 8 bombs AOKh-10, or 8 bombs KhAB-25, or 8 bombs KRAB-25YaD, or 2 bombs KhAB-200;

\* plane SSS could have a bombing load from 370 to 800 kg and transfer 20 bombs AOKh-8, or 20 bombs AOKh-10, or 4 bombs KhAB-25;

\* scout plane R-10 had a bombing load of 200 kg and could carry 10 bombs AOKh-8, or 10 bombs AOKh-10, or 6 bombs KhAB-25, or 6 bombs KRAB-25ЯД;

\* fighter DI-6<sup>275</sup> had a bombing load 40 kg and could transfer 4 bombs AOKh-8 or 4 bombs AOKh-10;

\* fighter I-15 bis had a bombing load 40 kg and could transfer 2 bombs AOKh-8, or 2 bombs AOKh-10, or 2 bombs KhAB-25, or 2 bombs KRAB-25YaD<sup>234,254,276</sup>.

In previous years the aviation chemical munitions was kept on artillery depots. However in the end 1930s the aviation direction has developed in Red Army so, that there were the specialised depots of aviaarms containing departments chemical munitions.

Data about some of these depots are resulted in table 5.9.

**Table 5.9 Pre-war Soviet aviation depots, storing the aviation chemical munitions**

Human settlement	Region	Number of depot	Formation	Capacity (waggons)
<b>West</b>				
Balakleya	Ukraine	29		
Belozerje	Ukraine	443		300
Berdichev	Ukraine	442	1937	
Bryansk		44		
Belaja Tserkov	Ukraine	436		300
Bobruisk	Belarus	389	1937	300
Brusovo	Leningrad military district			
Gomel-Pribor	Belarus	577		300
Gorodok	Belarus	576		300
Ichnja	Ukraine	730		
Konotop	Ukraine	578		300
Lida	Belarus	899		
Nezhin	Ukraine	309	1937	
Orsha-Cherveno	Belarus	386	1938	300
Polonnoje	Ukraine	662	1940	
Ponjatovka	Smolensk oblast	310		
Rovno	Ukraine	649	1940	
Sarny	Ukraine	647	1940	
Kharkov-Vasishjevo	Ukraine	580		1000
Chernigov	Ukraine	434		300
Chertkov	Ukraine	655	1940	
<b>East</b>				
Babstovo	Jewish Autonomous oblast		1936	200
Belogorsk-Kujbyshevka	Amur oblast	253		
Birobidzhan	Jewish Autonomous oblast	24	1940	150
Благодатное-Khorolsk	Primorski krai	575		200
Byrka	Chita oblast	313		130
Galenki	Primorski krai	118	1934	200
Knorring	Primorski krai	315	1936	300
Leonidovka	Penza oblast	76	1937	3000
Malmyzh-on-Amur	Khabarovsk krai	318	1936	400
Nerchinsk	Chita oblast	314	1934	150
Novgorod-Grigorovo		381		300

Novo-Sysoevka	Primorski krai	583	1940	200
Obor-Kruglikovo	Khabarovsk krai	21	1940	260
Petrovsk-Забайкальский	Chita oblast	151	1934	550
Zavitinsk	Amur oblast	316	1936	200
Razdolnoje	Primorski krai	319	1936	500
Sofijsk-on-Amur	Khabarovsk krai	12	1934	50
Spassk-Dalnii	Primorski krai	252		
<b>Others</b>				
Arys	Kazakhstan	42		
Buj	Kostroma oblast	50		

As a whole actions for transformation of aircraft in the operative factor of a chemical warfare have yielded expected results. Battle possibilities of aircraft during 1930s have seriously increased. A chemical weapon it has been saved up much<sup>481</sup>. Here with such aviation-chemical armada the army has come to the Big War<sup>101,260,289-292</sup>.

\* \* \*

*So, the party in power of those far years has firmly solved, that to the chemical weapon in the Soviet Country - to be. And those to whom it was entrusted, devoutly executed it. In practice of means of a chemical attack developed in the Red Army on all azimuths - from new chemical warfare agents any principle of action up to all possible means of an attack stood on arms of all arms of the service and all kinds of armed forces. In especially big degree of means of a chemical attack down to the World War II went to aircraft.*

\* \* \*