RECENT TECHNOLOGICAL DEVELOPMENTS OF THE CHEMICAL WARFARE SERVICE,
21 May 1946.

246-88

CONTENTS

Page

Introduction--Colonel Robert W. Brown, USA,
Assistant Commandant, The Industrial College of the
Armed Forces 1

Guest speaker--Major General Alden H. Waitt,
Chief of the Chemical Warfare Service. 1

General discussion. 14

Colonel Brown

Students

General Waitt

RECENT TECHNOLOGICAL DEVELOPMENTS OF THE CHEMICAL WARFARE SERVICE
21 May 1946.

COLONEL BROWN:

Gentlemen, I suppose it would be almost contrary to the law to start a lecture or a seminar here without saying something about the atomic age. So I use the term just to conform to the ordinary practice in the lecture hall. However, I have observed over a long period of time while we were speculating between World War I and World War II as to the chamber of horrors that would be let loose in World War II. It seemed at that time it was generally speculated or thought that the Chemical Warfare Service had a successor to this chamber of horrors. Undoubtedly they did have a pretty good chamber of horrors, and I suppose that we should all be thankful that that Pandora's box was not let loose in World War II. But, anyway, we have the Chief of the Chemical Warfare Service with us this morning to tell us something of the recent technological developments in the Chemical Warfare Service.

You will notice that heretofore I have been the introducer of small fry. I am glad to be promoted. But, unfortunately, there is always some drawback in connection with these unexpected promotions. The Commandant just phoned and stated that he felt too ill to come over to the College this morning and charged me with attempting to do the honors to the several distinguished speakers whom we have with us today. I assure you that it is a great pleasure to undertake this task. So we do indeed have a really distinguished guest speaker with us this morning.

Now, as to this gentleman I notice that whoever tabulated his record certainly did him honor, because I have 25 or 30 items that this gentleman has done. I shall not attempt to enumerate all of those things. I do notice, however, that he is a bachelor of science and a master of science from the Massachusetts Institute of Technology; he has been an instructor at the University of Kentucky; he has been Gas Officer for one of the most important divisions that we had in the United States Army; and he was the Gas Officer of the Armored Force, not to say anything about all the colleges and schools from which he graduated. Of course, he is a graduate from the Chemical Warfare School; and he has been an instructor at the Air Corps Tactical School. He is a graduate from the General Staff School, he has served on the General Staff; he has been Chief of the Field Service of the Chemical Warfare Service; and presently he is the Chief of the Chemical Warfare Service and a major general.

Gentlemen, it is a great pleasure to me to introduce to you Major General Alden H. Waitt.

GENERAL WAITT:

I am particularly happy to be here, because I feel so strongly that this Industrial College of the Armed Forces is one of the finest pieces of insurance that our Nation can buy against a possible future war. We found in the Chemical Warfare Service, as I am sure our friends in the other

services also found, that we have leaned very heavily on Army Industrial College graduates during the past few years. I am convinced that the pioneer work done in this College during the sixteen or seventeen years before the outbreak of World War II for providing a program of industrial mobilization was one of the biggest factors, if not the biggest, of our success in this war. It was a war that we won because of our tremendous industrial potential. Many of the senior officers who directed the effort were Army and Navy graduates of the Industrial College. I regret that I have not had the complete course at the Industrial College of the Armed Forces. I know that the course would have added much to my usefulness throughout the years. However, I do claim connection with the College, although my name is not on the rolls.

Back in 1924, when the Industrial College of the Armed Forces (then known as the Army Industrial College) was being organized, I was assigned to organize the first Chemical Warfare procurement district, with headquarters in Boston. As a preparation for this work I was sent, along with three or four of my colleages, to the Munitions Building, over on Constitution Avenue, where we were given a very short, intensive course by those officers who were at that time preparing to open the first course at the Army Industrial College. So we figured we were the first students of this College. We sort of broke the ground. They practiced on us. We had several weeks work. I guess it was not more than six weeks. It was largely reading, and that still useful volume "America's Munitions 1917-1918" by Benedict Crowell was our Bible.

From there, with that little preparation, I went to Boston, and for three years was engaged in organizing and operating the first Chemical Warfare procurement district. The work that we did there in industrial mobilization was constructive and useful. I am certain that if you look back at the records, you will find that we were able to shift rapidly from a peacetime to a wartime basis in the Chemical Warfare Service because of that early pioneer work in the five Chemical Warfare procurement districts.

Now, this talk that I make this morning is not so much on the technical development of the Chemical Warfare Service as it is on the relationship of the technological developments to industrial preparedness. I am going to say a number of things that you know very well. I am going to repeat many truisms, but I do it because I feel in my heart that they are so important that we must remember them.

I hope to demonstrate three major points concerning the effects of technological development on procurement planning:

First: The technological developments of the Chemical Warfare Service and the other technical services are dependent upon the changing tactics and strategy of the using arms--the Army Ground Forces, the Army Air Forces, and the Navy. These developments must be anticipated in advance if our planning is to be accurate.

Second: Technological developments are influenced by availability of materials. You know this very well. I want to emphasize this point. It is elementary and fundamental. Unless procurement planning provides for ample supplies of critical materials, technological advances are nullified,

or at any rate, they are delayed. I hope to give you instances through my talk how this works.

Third: To provide for new weapons, munitions and equipment as a war progresses, procurement planning must be flexible and continuous at all times. Close contact must be kept with a variety of industries in order to provide flexibility in the program.

Certainly you are all aware of the War Department's scientific and technological policy that was announced not over a month ago by General Eisenhower. Because this policy is so pertinent to our future operation, I am going to risk boring you by quoting from General Eisenhower's directive, which I hope you have all read. He says:

"Effective long-range military planning can be done only in the light of predicted developments in science and technology. As further scientific achievements accelerate the tempo and expand the area of our operations, this interrelationship will become of even greater importance. In the past we have often deprived ourselves of vital help by limiting our use of scientific and technological resources to contracts for equipment. More often than not we can find much of the talent we need for comprehensive planning in industry or universities. Proper employment of this talent requires that the civilian agency shall have the benefit of our estimates of future military problems and shall work closely with plans and the research and development authorities. A most effective procedure is the letting of contracts for aid in planning.

"The fullest utilization by the Army of the civilian resources of the nation cannot be procured merely by prescribing the military characteristics and requirements of certain types of equipment. Scientists and industrialists are more likely to make new and unsuspected contributions to the development of the Army if detailed directions are held to a minimum. The solicitation of assistance under these conditions would not only make available to the Army talents and experience otherwise beyond our reach, but also establish mutual confidence between ourselves and civilians. It would familiarize them with our fundamental problems and strengthen greatly the foundation upon which our national security depends."

The research and development program of the Chemical Warfare Service has been planned so that industry, science and the participating universities are considered as integral working and interested elements in our developments. We believe that the maximum benefits can be derived from this approach. I consider that one of my most important duties as Chief of the Chemical Warfare Service is to assure complete integration of my service and our chemical science and industry. If I can accomplish nothing else during my term, I will feel that I have accomplished much if I can weld together chemical science and industry and the Chemical Warfare Service. I consider it of most vital importance in total war--and all our wars from now on are total wars--that the civilians and military men be integrated completely.

Let me digress for a moment, because I see so many Navy uniforms here, to say that to a great extent the Chemical Warfare Service is the Chemical Warfare Service of the Navy as well as of the Army. For nearly

twenty-five years there has been a Navy section maintained at Edgewood Arsenal as a liaison unit. Similar Navy units are now established at Camp Detrick and Dugway Proving Ground. The Navy has looked upon us as their chemical warfare service, and we have done our best to respond. So I want our Navy friends to feel that we belong to them just as we do to the Army and to the Air Forces.

In the beginning it should be emphasized that the research and development functions of the Chemical Warfare Service are, in a large measure, in the nature of a service organization to the Army Ground Forces, the Army Air Forces, the Navy, and the Marine Corps. The offensive weapons and munitions, as well as the defensive items, are dictated by the strategy and tactics of our own Army and Navy and, too, by those of our enemies.

For example, the size, shape and weight of incendiary bombs and chemical bombs are dictated by the type of planes, the capacity of the bomb bays, and the manner in which the Air Force will drop the bombs. The type of bomb will also be dictated by the nature of the enemy target. The slate roofs of Germany were quite a different target from the flimsy roofs of the Japanese, and a different type of bomb was required for the attack on the Japanese structures from that for use on the Rhineland structures.

In order to determine the correct type of bomb for various structures, the Chemical Warfare Service built out on the salt flats of Utah a Japanese village and a German village. We got the best architects we could to erect those structures. We dropped bombs on them and watched just how best we could burn them. The character of the target influences our technology. It influenced very definitely the development of the various bombs.

Our defensive equipment and materials have to give protection against all chemical weapons. Thus, our gas mask must protect against all enemy toxic agents, as well as against any we might use. The same is true of protective clothing. We must watch our own developments as well as the enemy's.

When World War I ended, chemical warfare had played a very significant role. Phosgene and mustard had produced many casualties and were potent weapons against an enemy with inadequate protection or poor gas discipline. Some thirty percent of our casualties in the first war were from gas.

The Stokes mortar and the Livens projector had been developed to deliver gas at ranges of 1800 yards for the Stokes mortar and 800 yards for the Livens projector. The chemical cylinder was capable of releasing clouds of volatile gases such as chlorine and phosgene, but a favorable wind was needed, and their effect was good only a short distance from our own trenches. Flame throwers had been tried, but were considered rather ineffective except for some psychological effects.

Incendiary bombs of a crude type had had limited use in World War I, but were not considered by the requirements people as a potent weapon, although we of the Chemical Warfare Service thought they had great promise. Smoke had been used and showed much promise, and we were convinced that it would have a great value in any future war.

If procurement planning, research and development had been frozen shortly after World War I, our preparation would have been totally inadequate for World War II. This is proved by the many changes in tactics and weapons of the past war. These changes were due largely to technological developments during the period between 1920 and 1940. Also the scarcity of certain materials which had not been anticipated--natural rubber, tin, magnesium, tungsten, molybdenum and silk--made last minute development of substitute materials imperative. I say they had not been anticipated. That is not quite true. They had been anticipated here. The Army Industrial College in its studies had anticipated these things and suggested the building up of a stock pile on many of them. Your experts tried hard to get it done.

As World War II began to unfold, we saw the Germans using magnesium bombs on the British with devastating effect. The one-kilo and the two-kilo bombs were effective fire starters, and the British retaliated with similar bombs.

We had developed the rifled 4.2-inch chemical mortar, with a range of 2500 yards, with great accuracy, for firing choking gases and blister gases. At that time no high explosive shell was provided for this weapon.

Our gas mask was effective against the toxic gases and smokes of World War I, but it was too heavy to suit the Ground Forces in the amphibious and mobile operations which were anticipated.

The Livens projector was a weapon for stabilized warfare, but the mobility of the German forces against France indicated clearly that this war was not likely to be stabilized--certainly not in the primary theaters. So we did not do much with that.

Finally, it became evident that the airplane was to be a major factor in winning the war, and the design and development of airborne munitions required great acceleration.

When we entered the war, a high-ranking officer made the statement that we had no time to develop new weapons and munitions, but would have to fight with what we had. If procurement planning had been based upon that thesis and we had been limited by that planning, we would have had no 4.2-inch mortar with 4500-yard range, really up to 5500 yards, no flame thrower with thickened fuel, no thickened oil incendiaries, no large area smoke generators capable of sustained operation, no lightweight gas mask, and no new toxic chemical agents. In short, all of the weapons, munitions and defensive equipment for which the Chemical Warfare Service has been highly praised in this war were developed after Pearl Harbor.

As mentioned before, the magnesium incendiary was a new weapon of the Germans and British. Our attempts to duplicate these bombs were handicapped by our inability to obtain magnesium in large quantities, and we were forced to develop an incendiary with a steel shell containing a mixture of powdered aluminum and iron oxide, known as thermite. This was the M-54 bomb with which General Doolittle's party raided Tokyo. It did a fairly good job. It scared the stuffing out of the Japs, but it was not a really good all-around incendiary. We recognized the need for magnesium,

and our planners immediately started seeking sources from which this metal could be supplied.

American industry finally conquered the problem of making magnesium in large quantity, and we developed two magnesium bombs--the two-pound and the four-pound. This, of course, caused procurement planning to shift from aluminum and iron oxide to magnesium.

The slate roofs of Germany caused us to put an iron nose on the four-pound magnesium bomb, to improve penetration, so they would break through, and an explosive charge in it to discourage fire fighters. This bomb proved a powerful and devastating weapon against Germany, crippling her industrial facilities and gutting her rail heads and supply dumps.

It was soon realized, however, that Japanese targets were quite different. The heavy little magnesium bombs would crash through their roofs, bury themselves in the ground, and do little damage. Work was begun on a bomb that would not penetrate too deeply and would give a less intense but more widespread flame. Gasoline was plentiful, but when used alone the initial impact and explosion often blew out the flame or the gasoline was scattered too widely and gave a flash fire that did little damage. Rubber had been used to thicken gasoline, but it was no longer available and a new development was thus necessary.

Many chemicals were tried without success until a metallic soap was used. Metallic soaps had been used for years to thicken lubricating oil and make greases, but thickening the very thin gasoline was another matter. Finally a mixture known as "Napalm" was developed which would thicken gasoline at ordinary temperatures in the field. The 100-pound bomb, the M-47, and the 6-pound bomb, the M-69, were soon being produced in quantity and giving excellent account of themselves against Japanese and German targets.

This development of napalm immediately gave rise to another acute procurement problem--the supply of fatty acids and other chemicals needed to produce it. Several times one or more items became so short that a substitute had to be found, and the research chemists were kept dizzy working out new formulas to keep a steady flow of thickening materials going to the field. But the flow was kept up and Japan was burned to a crisp.

The atom bomb hastened the climax, but Japan was already on the ropes when it appeared. I was quite pleased when I listened to Dr. Karl Compton, one of the first civilians to visit Japan shortly after VJ-day, describe the effects of our raids on Tokyo. He said Tokyo was in a much worse condition than was apparent from aerial reconnaissance, much worse than we had thought. He stated that about seventy percent of the built-up portion of the city was destroyed, and he stated further that the destruction was all caused by incendiaries. Practically no explosive bombs were used. More recent reports by the United States strategic bombing survey confirm these statements, as well as pointing out the devastation which German industry suffered as a result of concentrated incendiary attacks. The survey report rates incendiaries as three to four times as destructive as high explosives in attacks on industrial areas.

There was a weapon that we did not have when we started the war, which we got only by pleading and constantly urging its adoption. We had no incendiary bomb when World War II started, although we in the Chemical Warfare Service had preached its value for the fifteen or twenty years before.

Incendiaries demonstrated clearly that procurement planning must be flexible, and it can be flexible only if the chemical industries of America are diversified and capable of rapid expansion. As the chemical industry of the United States grows and expands, so does our capacity to wage war and defend ourselves from an enemy. The War Department in all its plans must work closely with the chemical industry to insure a mutual understanding that will benefit national defense when the emergency arrives.

Thickened fuels that we used in our incendiary bombs opened a new field for flame throwers. A portable flame thrower using gasoline or fuel oil had a maximum range of about twenty-five yards. By thickening that gasoline we got a range of up to sixty yards. Large flame throwers in tanks attained a range of 150 yards. Today we have ranges much greater; and I note that the work our colleagues in England are doing indicates ranges well over 200 now and they are shooting for 400 yards. They believe these ranges possible for large armored flame throwers.

On Iwo Jima, Saipan, Okinawa and the other islands it was the portable flame thrower and its big brother in a tank that drove the Jap out of his cave and dugout or killed him in it.

I had the great satisfaction of talking with many commanders in the field during this war. I found that at Biak the flame thrower was considered a major weapon. At Bougainville, while we were still fighting and had occupied only a very small fraction of the entire island, I was with General Griswold, commanding the XIV Corps, and General Arnold, who had just taken over the American division. They told me that the flame thrower and the 4.2-inch mortars had saved them at Bougainville. Those were General Arnold's words. He said the flame-throwing weapons and the 4.2 mortar saved us at Bougainville. General Beightler, of the 37th Division, was in complete agreement with that statement. Units in the Pacific were very keen for flame throwers and flame devices.

With the large-scale production of these flame throwers, in addition to great quantities of gasoline and napalm, there came a demand for special high-pressure hose, for light steel that would stand high pressures, for hydrogen gas, and for nitrogen gas. The hose had to be made of synthetic rubber which would withstand gasoline, and here again the chemical industry produced the proper material in quantities sufficient to meet the demand--a procurement problem not even visualized in 1940. The increase in effectiveness of the flame thrower, and the acceptance of the item by troops, is evidenced by the increase in demand from nothing in 1942 to about 15,000 in 1944; and none of it planned prior to the war, nor could it have been planned then.

Finally there came that combination of incendiary and flame thrower--the fire bomb. At first this was just an extra airplane gasoline tank which a plane dropped. The Chemical Warfare Service adapted a small white phosporus

grenade to fit into the tank to ignite the tank's contents when it smashed on the ground. At first we just dropped them and came back and fired incendiary bullets into the fuel that had spilled out on the ground. Then we adapted a phosporus grenade as an ingiter. When the tank was filled with thickened gasoline and dropped at low altitudes, it produced a nerve-shattering sheet of flame 90 or 100 yards long and some 25 or 30 yards wide that started large fires and instantly killed those it touched. It was an anti-personnel weapon, effective against men on the ground. It was particularly effective at Saipan, and Tinian. It also burned vegetation from cave openings and exposed the opening for aimed fire from our tanks and infantry. A sodium-filled igniter was also developed to allow ignition on water.

The smoke pot, which gave a dense fume when the contents burned, was carried over from World War I. It had a short burning time, and the logistics of maintaining a smoke screen for hours was staggering. We could put up a small screen for four or five minutes to let a platoon get out of a difficult spot; but when it came to maintaining a smoke screen for several hours, we had an impossible logistic problem on our hands. We had to have smoke for several hours if we were to protect factory areas, depot areas, ports, or highways.

So with the help of the National Defense Research Committee and industry, two smoke generators were developed, that used fuel oil and water as raw materials. By heating the oil and forcing it out of special nozzles under pressure, a white fog could be produced which was not only an effective screen, but which could be operated for hours on end. This made it possible for us to put up tremendous smoke clouds over cities, over harbors, and over air fields.

The first generator, a large one, used one hundred gallons of oil per hour. The smaller model, which was developed later, used fifty gallons of oil per hour. These generators screened harbors, beachheads, supply dumps, and river crossings with notable success. The Anzio beachhead and the Moselle River and Rhine River crossings are good examples. While in North Africa, I was told, I think it was by G-4 of the top command, that, "No port or harbor installation has been successfully bombed by the Germans since these generators have been installed."

I saw them in operation in Algiers, Palermo and Naples. Once they got this smoke generator ready for operation, the Germans were unable to bomb successfully. It was quite interesting at Algiers to note how successful they had been. Algiers rises up steeply in a semicircle from its harbor. They placed smoke pots in small boats in the harbor. At the edge of the harbor large smoke pots were distributed along the esplanade and soldiers stood by ready to light them when the air raid signals came. Back up on the hill in the city itself they had these big smoke generators which took some ten minutes to get going. Radar gave about ten minutes warning.

As soon as the warning came, the men lighted the smoke pots on the harbor edge, and sent the smoke boats out, which gave an instantaneous screen over the shipping and docks. Then, by the time the airplanes got there ready to drop their bombs, the entire city was fogged over by the smoke pots in the harbor and by the big fog generators back up in the city.

The Germans confused by the smoke invariably dropped their bombs back of the city, away from the water. I was interested to note that some of these Germans who had been shot down were brought around afterward and shown the bomb holes. They said, "Why, we put our bombs right there on the edge of the harbor. We could not have missed. We saw them drop right at the harbor's edge, right where the docks are." We showed them the points where the bombs actually fell. The Germans could not figure it out. The fact was that they dropped them not at the edge of the water, but on the edge of the smoke. There had been a very effective camouflage in that way.

These generators caused large procurement problems. Two types of fog oil were needed--one for cold weather and another for temperate and tropical weather. However, our tremendous oil industry met the challenge quickly and we never had a shortage of either of these types of fuel.

The fog oil generators did not eliminate our need for the burning type smoke pots. We had to develop a floating smoke pot which could be dropped in the water from small craft, used for landing operations. When we decided on the Normandy operations, a tremendous planning requirement was established. We were unable to supply the demand. We were unable to procure the quantities which had been calculated as D-day requirement; so we had to extend our procurement planning internationally. Arrangements were made with the British to supply our European requirement, and we in turn would supply their African and MTO requirement. Fortunately, we had the mechanism for doing this combined work. In the United States we had the U. S. Chemical Warfare Committee, which had been organized early in 1942 at the direction of the Combined Chiefs of Staff. The British counterpart was the Inter-Service Committee on Chemical Warfare.

I went over there and dickered with the British. We made a deal whereby they would supply us sufficient from their stocks so that we would be ready for D-day; and we in turn would transfer to them later shipments from the States which would go to North Africa for their campaign in the Mediterranean Theater.

The need for colored smokes to signal from ground to air and between ground units posed a tremendous problem for procurement. It was a problem not in size, but in difficulties which had to be overcome. Dyes had to be procured which would be stable in a well-defined colored smoke in the air. Small quantities, hard to get--a tiny but important procurement problem.

The M-16 grenade, which burned for two minutes and gave either a red, yellow, green or violet smoke was an effective aid in preventing our own air forces from bombing our front lines through inability to recognize them. Unfortunately they were not always used. Maybe they were not always available. Many good soldiers were killed, including the Commanding General of the Army Ground Forces, General McNair. Proper use of colored smoke might have prevented this.

When rubber gave out, the Chemical Warfare Service was faced with a crisis. The face piece of the gas mask was made of rubber. We had to get

a substitute which would be gas tight, comportable, flexible at temperatures of 40 degrees below zero, and not sticky in the tropics.

Chemists were told that butyl rubber would be available; but when we finally learned how to vulcanize it, the production did not come through. Here procurement planning had simply fallen down. Here procurement controlled technology. Another long, tedious search had to be made to find a way to use neoprene, which procurement said would be available. It was solved, and millions of gas masks were made with neoprene. When the war ended, we were about to run out of neoprene; but we were prepared to use butyl, which was again available.

Any future procurement planning must include a variety of synthetic rubbers which can be produced in large quantity, for we might be cut off from rubber again. Of course, it might be possible to build up a supply of rubber in South America, so that raw rubber could be readily obtained nearer the United States; but even that should be doubted in our planning. During peacetime we should conduct extensive research to develop synthetic products easily made from readily available raw materials. So much for our equipment.

A word now about gas itself. Toxic chemicals were not used in the past war, but that does not mean they will never be used again. Toxic gas is a weapon of surprise and opportunity. Against an enemy that is unprotected it can be devastating and disastrous to its armies and civilians. The Germans had gases that were unknown in World War I, gases which were much more potent than World War I gases. They would have used them if we had not had protection against them and had not been able to retaliate in kind.

I saw the tremendous preparations which the Germans had made for waging gas warfare. I went over about two or three weeks before the surrender and followed the armies into Germany. After the surrender I visited central and northern Germany and Austria. We in the Chemical Warfare Service who were responsible for the program had been worried because we had not turned up any German gas as we moved through France and western Germany. A few of us who were responsible for the planning and establishing the requirements wondered if questions would be raised after the war as to whether we had been thoroughly justified in spending money of the Government and insisting that there be placed over in England quantities of gas for retaliation. No gas depots showed up when we came into Normandy. No German gas appeared in France. No German gas appeared before we got to the Rhine. But after we got across the Rhine it began to show up in tremendous quantities. We discovered large stocks of gas in central Germany, scattered all through the country. The tremendous German effort and potential were apparent, once we had gotten into the central part of the country.

After the surrender, when I saw these things, I realized that we had been well justified in all our preparations. As a matter of fact, we had won a gas war without firing a shot, without dropping a bomb. I saw the tremendous installations at Raubkammer--tremendous proving grounds, pilot plants, and depots. This one proving ground at Raubkammer was the

equivalent of our Edgewood Arsenal and Dugway Proving Ground combined. It was equipped with splendid facilities. I do not have time to tell you about them. I can only assure you that I was amazed at what I saw there.

Several bomb-storage depots were located at Raubkammer. At Muna ost, a few miles away, there was a storage depot for chemical mines and artillery and mortar shells. There was a tremendous quantity of munitions there. The Luftwaffe gas storage depot was located at Oerrel. Here I saw 175 beautifully camouflaged concrete bunkers all filled with 250-kilo and 500-kilo bombs charged with phosgene, mustard, and the new German gas, green ring 3--thousands upon thousands of bombs and all of them invulnerable against attack. We might, if we could have gotten a direct hit on one of these bunkers with a thousand-pound bomb, have destroyed it; but only by a direct hit. They were beautifully hidden. As a matter of fact, we did not know of any of these installations until we got in there. They had not been located by allied intelligence.

The same thing was duplicated all through central Germany. In all we located approximately a quarter of a million tons of toxic gas-munitions and bulk agent. What do you suppose they figured on doing with those quarter of a million tons--250 thousand tons, not pounds? What do you suppose they had that for? Why did they not use it?

The fact that we were prepared--that we had gas overseas in England ready for instant retaliatory use, and finally, that we had the great potential of our arsenals and industry--is why they did not use gas at Normandy when we landed. I am confident of this, and it is one of the best lessons in preparedness the American people can have. We prevented a gas war by being ready!

I am sure that a gas war would have set us back six months if they had dropped large quantities of gas on us when we were concentrated in small areas on the beaches in Normandy. I am just as sure of that as I am sure of anything. Had the gas appeared at Normandy, it would have delayed us seriously. It might have given the Germans time to get ready their V-3 or V-4 or whatever their next great technical development was going to be. But they did not dare to use it, because they knew if they did, their cities would have been drenched with gas.

I am not sure they made the right decision. I am not sure that the six months' advantage might not have been worth to them the terrific shellacking they would have gotten from our gas. It was a difficult decision. They decided not to use it. I am sure the only reason they decided not to use it was because they knew we were ready, and could retaliate heavily and effectively.

Future Chemical Warfare Service procurement planning requires a large organic chemical industry as well as a large inorganic chemical industry. The gases or toxic agents of the future will be many hundred times more potent than presently manufactured ones. This is no day dreaming, for already we know of agents which are that toxic and only await a suitable means of delivering them on the enemy. This problem will be solved in

time--we are on the edge of it now. In the event of another war, someone will be called upon to procure these agents, which we now have in the laboratory--agents which are a thousand or more times as effective as the mustard gas and the phosgene that we have known for the past thirty years.

War production is not just a matter of industry's accepting contracts and manufacturing the war products called for. No; it is much more. It requires, in the early stages, planning and carrying out the complete reorganization of existing plants, facilities and personnel for entirely new businesses. It involves removing and/or retooling peacetime equipment, procuring and installing specialized production equipment, constructing new plants, and engineering and scheduling the production of intricate war materials on a scale which before World War II we would have thought impossible.

To emphasize the need for a sound, aggressive and continuous procurement planning policy, I shall quote from the General Motors Corporation's 37th annual report. It just came out. This is the report for the year ending 31 December 1945. I read it with much interest, and I want to quote briefly from it. This is a big industrial organization speaking.

"Over the years industry had developed a high degree of coordination within the economic life of the Nation. It had learned to make efficient use of plants, machines and raw materials. It had learned the complicated technique of coordinating from many sources the flow of supplies essential to quantity production. Most important of all, it had learned how to translate technological developments into useful products.

"This peacetime experience was basic to industry's war contribution. But it might have been capitalized upon even more effectively in the early planning phases of the war production program, had public interest in military preparedness been more acute before the war. Also, there was relatively little organized liaison between industry and our Armed Forces in peacetime. The technical staffs of industry were little acquainted with military equipment. Many war products that were to be needed in great quantities and in record time had not been designed for manufacture on a mass production basis. All this because our prewar military leaders were not given the means to undertake a program of the necessary magnitude. The cost of the war, in human life and also in material values, might have been importantly reduced and the war shortened, if we had been better prepared."

I hope that is read by many people. It is a lesson that perhaps we here do not need to learn. I think we appreciate it. But it would mean so much if our legislators and if our citizens with their vote could know it really. So far as possible, that lesson should be spread.

The war of the future will come upon us suddenly; you know this as well as I do. You have been told it so many times. But, again, we must not forget it as the years go by. The war of the future will come with sudden impact on us. We are the ones who are going to have to be ready. Little or no warning will precede a large-scale surprise attack aimed to wipe out or seriously cripple our critical industrial and military

establishments. Organized, effective and continuous liaison between industry and the Armed Forces must be maintained to insure that the scientific and technological assets of the Nation are coordinated into the national defense program. We cannot afford to take the calculated risks that were taken in the past concerning this coordination. We cannot afford to let the lessons of World War II go unheeded. Coordination with industry and science must be the keynote of our military planning. So far as I can, I intend to assure that our Chemical Warfare Service and American chemical science and industry are coordinated. The Industrial College of the Armed Forces is an agency of tremendous importance in insuring our future preparedness in this respect.

This war has taught us several lessons that should guide us in the future. One of them is that, although a war may begin with the weapons and defenses not far advanced over those of the previous war, these can be radically changed in a matter of months by new technological advances.

It has taught us that materials which are imported in plentiful supply during peacetime may be reduced to zero in wartime. Imports from any source cannot be depended upon. This country must stockpile certain basic materials or be able to produce them in large quantity if needed. I hope the Industrial College of the Armed Forces will push that. These are metals, petroleum and its by-products, vegetable oils, cotton and wool. We are going to need them. This is particularly true of those normally in short supply in the United States.

Following a war, public interest in war problems diminishes, oh God, how quickly. Demand for civilian goods and services tends to absorb all the efforts of industry. The psychological drive present in wartime disappears. Public appreciation of military needs approaches the vanishing point. It is essential, of course, for industry to turn now to its important peacetime tasks. Yet, if the peace is to remain won, there must be continuing close liaison between the Armed Services and industry and science in the years ahead; and you who are students here today are the people who have to carry the torch.

The future security of the Nation demands that all those civilian resources which by conversion or redirection constitute our main support in time of emergency be associated closely with the activities of the Army in time of peace.

Success in this enterprise depends to a large degree on the cooperation which the Nation as a whole is willing to contribute. However, the Army as one of the main agencies responsible for the defense of the Nation has the duty to take the initiative in promoting closer relation between civilian and military interests. It must establish definite policies and administrative leadership which will make possible even greater contributions from science, technology and management than during World War II.

To achieve success and to insure the defense of the Nation, procurement planning must be flexible and continuous, so that a variety of

industries will be prepared to expand in whatever direction the war turns. We must know the capacity and capability of our industry. We must plan with industry and labor; know them and work out our problems with them in advance.

This Industrial College of the Armed Forces is the best possible insurance we can purchase. Here we have the place, the facilities and the talent for working out our procurement plans for the Army, Navy and the Air Forces. Here we can have a meeting of minds between industry, science, management, labor and the Armed Forces.

Thank you.

COLONEL BROWN:

Gentlemen, General Waitt has condescended to answer any questions.

A STUDENT:

General, I found that where we crossed up with the Army most on procurement, the instance that comes to my mind most vividly, was in the Freon bomb. We finally got that up to four million pounds per month. But that could have been done months before had we known at the time what the ultimate needs were going to be. So the first thing they did was to confiscate all the five hundred thousand pounds that I had and put that in the bomb. They did not even have facilities to make it. I think before we go into a new field, we should see what the production capacity of that field is.

GENERAL WAITT:

There is no doubt that you are correct. There should be very close cooperation and close coordination. We had war agencies that were accomplishing that. We had set up the proper machinery to prevent what you refer to. By the way, the Chemical Warfare Service had nothing to do with the Freon bomb.

We endeavored through the U.S. Chemical Warfare Committee to turn over to the Navy information as to what we were doing. We had a very effective liaison so far as our planning was concerned. It might have broken down in the lower levels. On the top echelons I am convinced that there was a very close knowledge of what was going on and what each one was doing. There must be some method found of correcting these races between the agencies for materials.

A STUDENT:

Did the Japanese have much of a gas program?

GENERAL WAITT:

Their program was not very great. The Japanese realized that as soon as we entered the war it would be fatal for them to use gas. So they

stopped their production of offensive materials soon after Pearl Harbor. They did have some stocks of mustard, lewisite and some of the irritant smokes, but not in significant quantities.

A STUDENT:

Did the Japanese actually use gas in combat?

GENERAL WAITT:

Yes. I am convinced they did. I do not know that I could go before a court and prove it, but I am convinced that they used it against the Chinese at Ichang and Chengsha back in 1941.

COLONEL BROWN:

Thank you, General Waitt. I am sure that if he were present, the Commandant would express his appreciation and that of the class to you for this most interesting lecture on a highly technical subject.

- - - - - - - -

(14 June 1946--200.)S

25-89141-200