Vol. 27 April, 1941 No. 2

CHEMICAL WARFARE BULLETIN

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CHEMICAL WARFARE BULLETIN

Published Quarterly
by
The Chief of Chemical Warfare Service

A review of developments in the
application of chemicals
to military effort.

REPRODUCTION PLANT
CHEMICAL WARFARE SCHOOL
EDGEWOOD ARSENAL, MARYLAND

UNIT GAS OFFICERS' CLASS (AVIATION)
(March 31st - April 26th, 1941)

This group of 75 students is the largest officers class ever to attend the Chemical Warfare School.

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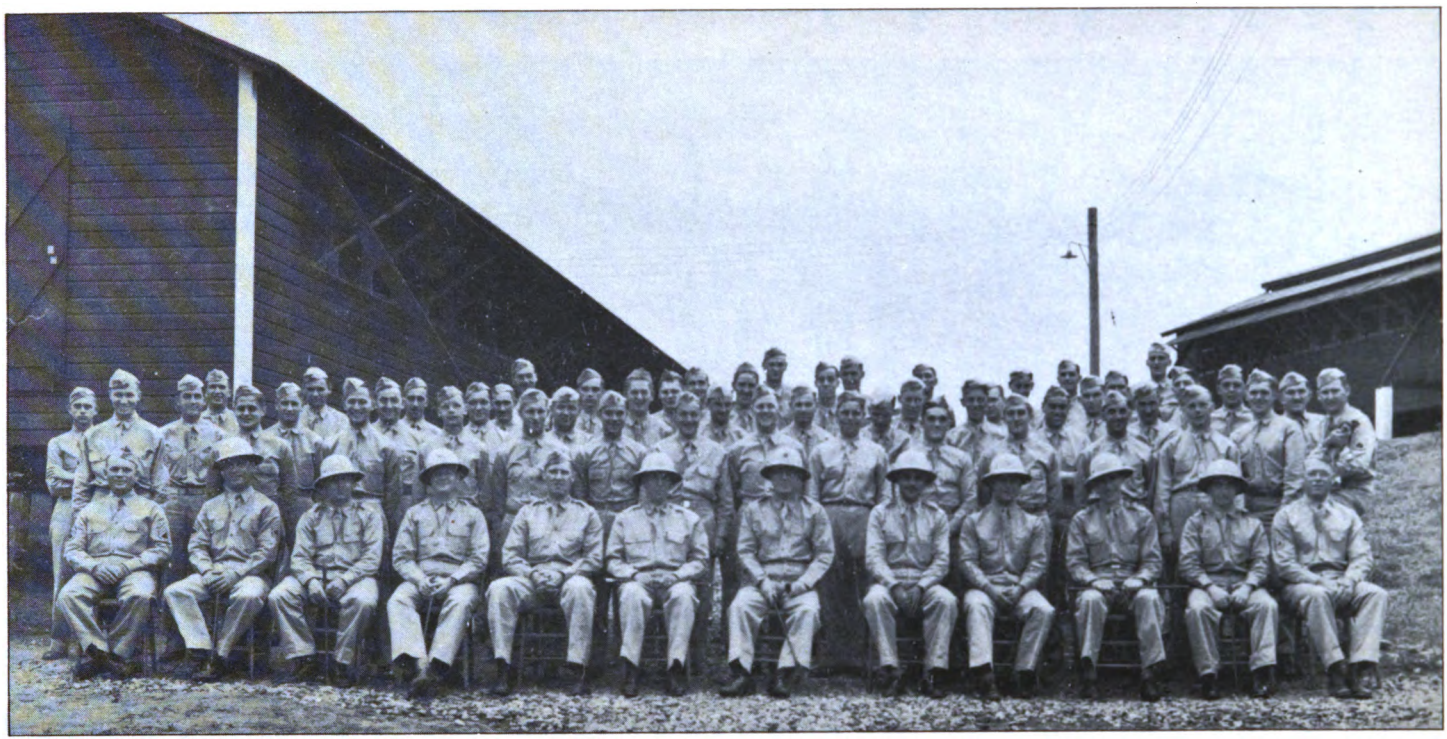
Views expressed in signed articles are those of the writers and should not be construed as official.

Original articles and discussions are welcomed.

Address all correspondence to "Editor, Chemical Warfare Bulletin, Edgewood Arsenal, Md."



Signal Company, Aircraft Warning, Puerto Rican Department

This company recently completed a 15 day course of instruction in defense against chemical warfare under direction of the department chemical officer.

SUPPLY REQUIREMENTS OF THE SEPARATE CHEMICAL BATTALION*

It is necessary that each commander know the combat capacity of his unit. The capacity of a unit for sustained combat is dependent on the supplies available. There must be a systematic, orderly, and simple system of supply that will enable the army commander to control the flow of supplies into the combat zone.

For simplicity and convenience of administration, military supplies are divided into five groups:

Class I - Articles, such as rations, consumed at uniform daily rate and issued on the basis of daily strength returns of men and animals.

Class II - Authorized articles of equipment such as clothing and gas masks which, although consumed at approximately constant rate, require special arrangements to meet individual needs.

Class III - Motor fuels and lubricants.

Class IV - Articles not covered by tables of allowances,demand for which relate to operations contemplated or in progress.

Class V - Ammunition.

The army commander arranges for the flow of supplies for his divisions, corps,and army troops, and for GHQ troops which may be attached.

The separate chemical battalion in combat needs all classes of supplies, the source of which are army supply installations in the army service area of the combat zone.

In the army service area are established depots and railheads;normally one railhead for each division. Branch depots, at which all supply branches are represented, are usually adjacent to railroad sidings and should be accessible to good road nets. Quartermaster, medical, engineer, signal,ordnance, and chemical-warfare branch depots are established for Class II and IV supplies.

Such storage is temporary; often under adverse conditions with supplies limited to items essential to maintain combat

**Compiled from Chemical Warfare School instructional notes.*

efficiency for one to two days. As far forward on the railroad net as the situation permits, railheads for Class I supplies (rations and forage) are established. The arrival and unloading of the daily train,as well as distribution to units, should take place under cover of darkness.

The army also establishes supply points (railhead or depot) for ammunition. A minimum of two supply points per corps should be established.

The army quartermaster establishes supply points for gasoline and oil (Class III), at railheads, depots, or at convenient locations such as civilian gasoline filling stations on main supply roads.

The separate chemical battalion uses its motorized train to haul all classes of supplies from the army supply points to weapons companies. Except for sixteen 1½-ton cargo trucks and sixteen 1-ton trailers used as weapons carriers, all trucks of the companies are considered a pool of transportation to be used by the battalion as required.

In combat, trucks pooled in the battalion motor park may be used to haul any class of supplies demanded by the situation. Command reconnaissance cars assigned to platoons, companies, and battalion are seldom pooled, as they are usually in the forward echelon. When a weapons company is operating independently or on a flank where the distance to the battalion motor train bivouac is too great for close cooperation, vehicles organic to the weapons company remain under the control of the company commander who establishes his own motor train bivouac.

In combat the number of men and vehicles brought under fire must be held to the minimum necessary for the handling and security of the chemical weapons and ammunition, and for reconnaissance. All other personnel remains with the rear echelon at the battalion train bivouac where maintenance, supply and administrative functions are carried on by the battalion headquarters company. All material is located in irregular and varied size groups and must be camouflaged.

Near the entrance to this area is located the headquarters of the battalion executive who commands the train bivouac. He supervises all battalion supply and administrative facilities.

The supply section under S-4, (a first lieutenant) is responsible for the supply of all material except ammunition;for maintaining all supply records; and for the consolidation and preparation of requisitions for supplies. S-4 establishes a receiving and distributing point near the entrance to the bivouac area, a service station for motor vehicles, and a motor repair shop. He usually accompanies the supply train to the railhead.

The battalion munitions officer (a first lieutenant), commands the battalion ammunition train and operates the ammuni-

tion distributing point, from which the flow of ammunition to the companies is controlled.

Close to the headquarters company is located the supply officer's office group. Here is set up the rear echelons of the four weapons companies. Each company is represented by a company executive, first sergeant, supply sergeant and a company clerk. Each group receives supplies for its company,and under the supervision of the battalion sergeant major maintains company personnel records.

In one portion of the bivouac all company kitchens are irregularly placed and carefully camouflaged.

A battalion service station is located near the motor park for servicing motor vehicles that have no occasion to go to the rear. For this purpose gasoline and oil, transported in 10-gallon nonexpendable containers, are transported to the battalion filling station by gas and oil trains from army supply points.

The issue of rations is automatic and is based on the strength return submitted each day by the chemical battalion at a time specified by the army. The battalion sends a Class I supply train daily to the railhead of the unit to which it is attached. Normally only rations for three meals are obtained at one time, and these can usually be carried by three trucks. All other supplies, such as ordnance (except ammunition), signal, engineer, medical, chemical and quartermaster are procured by requisition through the supply officer of the unit to which the battalion is attached.

The separate chemical battalion requires chemical ammunition for chemical troops, as well as small arms ammunition for pistols and automatic rifles. Ammunition for chemical weapons is obtained from the army chemical-warfare depot which supplies Class II and IV chemical supplies to all troops, and chemical ammunition used exclusively by chemical troops. Ammunition for small arms is obtained from the unit to which the battalion is attached.

The kitchen section has a capacity of one ration. The supplying of food is greatly facilitated if the cycle of meals begins with supper. In this way the kitchens will be empty after the noon meal has been issued (ordinarily issued to front-line troops at breakfast in the form of cold lunch), and can reload with one complete ration in the afternoon or at night. As the tactical situation requires, men may be fed at the mess location, or at the various platoon locations by carrying parties. The following rations are prescribed:

Field Ration A: Corresponds to garrison ration (perishable).

Field Ration B: Same as A but with nonperishable components.

Field Ration C: Previously cooked balanced ration;six cans

per individual ration, three of meat and vegetables, and three of crackers, sugar and coffee.

Field Ration D: Three 4-ounce chocolate bars per individual ration.

Each weapons company is equipped with 24 handcarts pulled by four men. The cart can carry one mortar (337 pounds) and 10 rounds of ammunition (325 pounds), or a total load of 662 pounds. The gross weight (cart and load) is 816 pounds. This then would be the load taken to the front lines for the initial large-scale chemical operation. In difficult terrain, only the mortars would be taken to the forward position and installed by the corporal and two men. The ammunition would be carried by the same carts on subsequent trips. This, of course, would increase the time element.

In situations requiring smoke in close support of Infantry, the chemical weapons company would be streamlined by organizing it into six mortar squads with the remainder of the company organized into ammunition squads, and the 24 carts used for carrying six mortars and 180 rounds of ammunition. In this case the load would be approximately 300 pounds per cart. This reduced load would allow the chemical troops to follow in close support of advancing Infantry. Mortars not needed in smoke operations would be stored at the company distributing point or at the mortar park in the battalion bivouac area.

The separate chemical battalion has sufficient transportation to carry into the combat zone 3,360 rounds of chemical mortar ammunition. Of this, the four weapons companies carry 960 rounds; ten rounds with each of the 96 mortars. The remainder is carried by four sections of the battalion ammunition train. Each section, under the command of a sergeant, consists of four 1½-ton trucks and four 1-ton trailers. Each truck-trailer combination has a capacity of 150 rounds of chemical mortar ammunition and is accompanied by two ammunition handlers.

Usually in large scale operations the battalion commander is notified by the chemical staff officer of the unit to which the battalion is attached, as to the initial chemical mission. The battalion can then advance from the GHQ area, far in the rear, to the forward assembly area with the correct quantity and type of ammunition needed for the initial chemical operation. If the needed ammunition is not on hand, the battalion ammunition train may stop at the army chemical-warfare depot in its advance to the forward assembly area, obtain the ammunition and deliver it directly to the company ammunition distributing point.

For an impending operation, the battalion commander, on the recommendation of the battalion munitions officer, specifies the battalion distributing point in the battalion order. The site selected is usually as far forward as possible, in order

that the ammunition train can be kept intact, under the control of the munitions officer as long as possible. The battalion ammunition distributing point is usually where the munitions officer begins to dispatch sections of the battalion ammunition train to the various weapons companies. Through this installation the battalion munitions officer and his assistant, the ammunition sergeant, control the movement of the ammunition vehicles and facilitate the supply of the correct type of ammunition to the weapons companies. When empty the vehicles return to this point and again come under battalion control. Unless the situation makes it imperative, ammunition will not be dumped at the ammunition distributing point. Sometimes, however, with the entire battalion engaged in a large-scale chemical operation, the battalion ammunition distributing point may be established as far forward as possible; and the ammunition from the battalion ammunition train may be dumped here for company distribution.

It is to be noted that the prescribed loads do not include sufficient ammunition for an extended engagement or for replenishment of ammunition for succeeding operations. Therefore it will sometimes be necessary to stock chemical ammunition in the battalion combat area. Consequently, after the ammunition initially transported with organic vehicles is delivered at the company distributing points, the battalion ammunition train returns to the battalion distributing point. Empty vehicles will be sent by the company commanders to this point where they come under battalion control. All available transportation is also pooled, and the necessary vehicles commence hauling ammunition from the army chemical-warfare depot through the battalion distributing point to the company distributing point.

For schematic location of supply points for separate chemical battalion (motorized) see chart following page No. 53.

STRATEGY OF INCENDIARIES*

Col. J. Enrique Zanetti, CW-Res

The rediscovery of fire as a weapon of war, after several centuries of oblivion, is too recent to have drawn the attention of military minds that the importance of fire demands. The haphazard use of the incendiary bomb,both in the World War and in the present conflict, indicates that only perfunctory thought has been given to the subject. This neglect on the part of military authorities is doubtless due to the fact that the potentialities of fire and the methods of combating it have been essentially civilian studies, the concern of fire commissioners, bureaus of combustibles, and boards of fire underwriters. It is to the experience of these agencies that the military must turn for help in facing the serious problem of fire control and even the basic principles governing the use of fire as an offensive weapon.

It is a rare occurrence, indeed, that a new weapon should find a defense already organized and a literature far wealthier in methods of combating its effect than in the technique of its use. A glance at the catalogue of any large library will disclose a voluminous array of reports, journals, manuals, and historical publications dealing with fire fighting, but one must search military publications to find any data on the use of fire as a weapon, and the data are scanty at that.

An old enemy of man, fire has been fought for centuries under the most varied circumstances. The vast accumulation of data on fire fighting rests, however, on the assumption of accidental, and only to a very limited degree on intentional, fires. The depredations of the arsonist and the pyromaniac are comparatively small. The defense against fire as a military weapon may present a problem on a greater scale and under far greater pressure than has ever been recorded. Fortunately, the offensive use of fire is still sketchy, and its vast possibilities have been barely studied. There is sufficient evi-

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dence that this is the case in the inefficient, even inept,way in which incendiary bombs have been used in the present conflict.

Whether one is prepared to accept the long-foreseen "all out" type of warfare, in which the destruction of civilian morale plays such an important part, or whether one condemns it as brutal, inhuman, and uncivilized matters little, all out warfare is here and must be faced. Even the time-honored formula of "military objectives" has been dropped. Hence, not only the passive type of defense but the active one of attack must be studied, planned, and executed with all the energy and foresight that can be commanded.

The most casual study of data on fires indicates that the one great dread of the city (the focal point of the civilian attack) should not be the isolated fires that may spring up during a raid but the merging of separate fires into a conflagration.

By going into the literature on conflagrations, one can get an idea of the power and destructive intensity of a fire when it is out-of-hand. It is elementary that such an achievement should be the aim of the users of incendiary bombs when attacking combustible areas in large cities. Yet, incendiaries have been used without regard to a definite plan or purpose and under conditions which could not have been more thoroughly arranged to reduce their maximum efficiency. The simultaneous or subsequent bombardments with high explosives, which have marked every reported attack with incendiary bombs, have provided the most thorough check to any possible conflagration. The reason is not far to seek. Since the days of the ancient Romans, conflagrations have been stopped by razing houses in the path of the flames; this the demolition bomb can do to perfection. Simultaneous use of both incendiary and demolition bombs indicates lack of planning, coordination, and, especially, lack of realization of the potentialities of the incendiary bomb.(1)

Much research has been done in the production of incendiary materials, but little appears to have been accomplished in the technique of their use. The development of fire offense will call for an extension of military organization and the creation of a new specialization, which in turn will call for a training not to be acquired by the simple process of command. Military intelligence reports and maps will have to be concerned with the location of combustible areas, since not all areas can be subjected successfully to incendiary attacks. Machine shops, foundries, and metalworking factory districts are hardly suitable to incendiary attacks,but certain chemical ex-

(1) Well placed explosive bombs have however seriously hampered firefighting by destroying water supply systems - Ed.

plosive factory areas, alcohol distilleries, and, especially, warehouses and docks are targets which will be sought for spraying with small incendiary bombs.

Particular attention will be given the poorly constructed districts--slums, old-law tenements,and the like. If correctly mapped and adequately sprayed with incendiaries, these districts would constitute areas in which to start a dangerous conflagration. So great is this danger that,from the point of defense, the removal of the slums will before long cease to be a purely humanitarian undertaking and become an item in a program of national defense.

In the use of the incendiary bomb, one must at all times remember that only about 15 percent to 20 percent of a city's area is covered by buildings, the rest being streets, back yards, parks,etc. At least 80 percent of the bombs used will, therefore, be wasted, since they will fall on open ground and burn harmlessly. It is estimated that about half of those falling on buildings will glance off or fail to function because of internal defect; only ten percent will actually start fires. This figure is probably too high, and about five percent is more likely to be right. It is clear that incendiary bomb attacks must be massive and extensive to produce results.

Meteorological data will be of importance in the strategy of incendiaries. Studies of prevailing winds and precipitation distribution will be of major importance. Incendiary attacks in wet seasons can do only local damage and preclude the accomplishment of the primary object of the incendiary attack, namely, the conflagration. Local and disjointed damage in cities could just as well be inflicted by high explosives.

While the incendiary bomb is considered a strategic rather than a tactical weapon, its tactical uses are not negligible. The harassing of landing parties is not the least of them. In this as in many of its other uses, the advantage of a large number of small units released over an area without the necessity of specific aiming is worth considering. A transport on fire when the landing troops are about to shove off would hardly be conducive to smoothness of operation. The same advantage of multiplicity holds in attacks against ammunition dumps, supply columns, and advance depots, all of which, containing much that is combustible, are apt to be guarded by antiaircraft batteries and machine guns, thus making it necessary to attack from great heights.

Finally, the use of incendiaries against commercial ships cannot be eliminated, since only war vessels so far have decks protected against airplane bombs.

The preceding discussion has had as its object emphasis of the possibilities of incendiaries and direction of competent thought towards defense. For a defense there is or will be. No weapon has ever been invented against which a defense has

not been worked out sooner or later. The race between armor plate and the armor-piercing shell is too well known to need more than passing comment. Much thought, work, planning, and experimenting was necessary at each step to keep up with the progress of one or the other. And much thought, work, planning, and experimenting will have to be done before any satisfactory defense will be developed against fire, the old weapon which the extension of warfare into a third dimension has endowed with possibilities as yet but little explored.

The men who experimented with and devised alloys and methods of tempering armor plate to meet the increasing power of the striking shell were engineers and experts in their fields. The men who are to develop defense weapons against fire must be those whose lives have been spent in fighting it, men who have studied the materials and the methods of diminishing the damage caused by fire and the laws and the regulations to prevent its spread, men who know how to organize to meet emergencies. The development of defense weapons must, however, be done with military cooperation, since only from the military can the power and methods of newer incendiary techniques be learned and methods to guard against them thus devised. Only by working closely together, the fire-fighting and fire-prevention organizations on one hand and the military organization for offense on the other, can essential progress be made in the varied and fertile technique of this reborn weapon.

* * * * *

"The military records of all time, are a standing evidence that a trained and developed mind is not the enemy, but the active and powerful ally, of constitutional hardihood."

- Van Wyck Brooks
(New England: Indian Summer, page 177).

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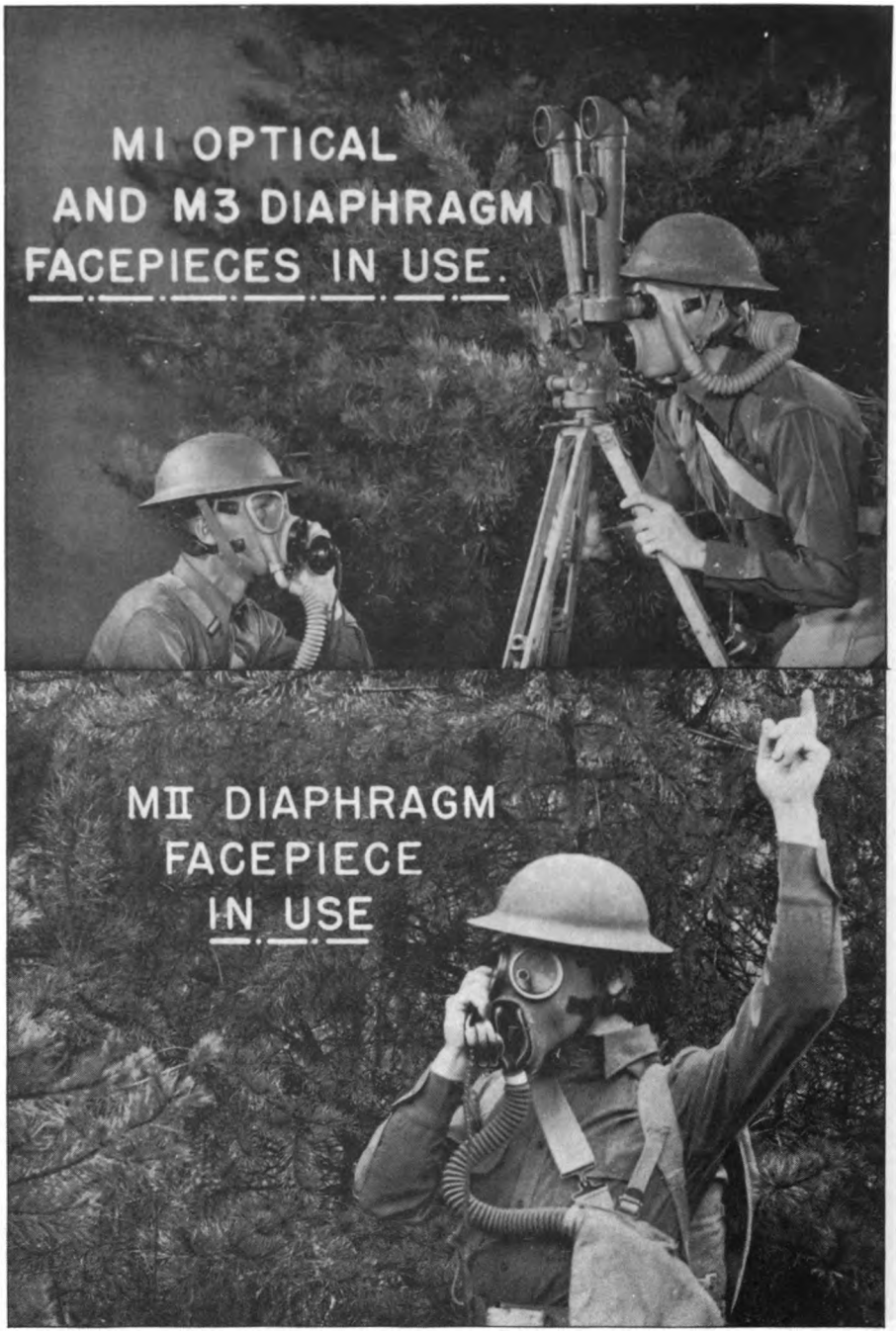


INDUSTRIAL EXPANSION IN CHEMICAL PREPAREDNESS*

Raymond L. Hoadley

One of the sensational events of the World War was the visit to America of a German submarine bringing a cargo of synthetic coal-tar dyes. A wild scramble for the dyes ensued, as in those days the United States was without a synthetic-chemical industry of any consequence.

But out of the necessities of that war this country's independent chemical industry took root, and, as a result, the United States now is self-sufficient in many of the strategic materials that had to be imported in 1914. In fact, the official list of such defense materials that must be obtained wholly or in part from foreign countries has dropped from fifty to fourteen in the last twenty years.

Today this war-born industry is encountering a record-breaking demand for its products in nearly every industrial field, and through its research, new materials and defense-plant expansion, is making chemical preparedness a vastly different picture than in 1914. A current survey shows that aside from a few tight spots here and there, the industry is fully prepared to meet defense needs, and even the new aid to Britain that will be superimposed.

The scarcity of ammonia is greater than that of any other important chemical used in the defense program. Nitrogen, obtained from the air in the form of synthetic ammonia, is one of the essentials for smokeless powder and other military explosives. Because it is without tariff protection in the only free ammonia market in the world, the output of this product approximates only 480 tons a day--a capacity many times under that of Germany and inadequate for defense purposes.

In this emergency, export has been stopped, and the Allied Chemical Company, E. I. du Pont de Nemours & Co. and the Tennessee Valley Authority are building new plants inland from the "vulnerable attack areas". These facilities will provide

**Abstracted from article by Raymond L. Hoadley and reprinted by courtesy of New York Herald Tribune.*

production sufficient for defense requirements. But these take twelve months or more to build and in the meantime the huge government powder plants to be operated by the Hercules Powder Company and du Pont will start running in April and May ahead of schedule and before the ammonia plants will be ready. Thus a tight situation probably will develop this summer whereby mandatory priorities in ammonia may become necessary.

Already the ammonia trade has been requested to cut down on deliveries for civilian consumption. Meanwhile, as the aid-to-Britain program is being formulated, plans to augment the present ammonia-production expansion are in the study stage. Like the three plants now being built, the new units will be "ordnance-owned and agent-operated". The War Department probably will select sites in the Middle West at locations near natural gas or coal deposits.

Chlorine is another chemical used in explosives in which some scarcity may occur before expanded facilities are available. This product also has widespread commercial uses as a water purifier and as a bleaching agent for paper and other products. Chlorine output has been stepped up 30 percent, and surveys are under way to determine how much more capacity will be needed to meet the abnormal demand looming ahead. Here, again, the government will sponsor most of the new expansion.

A shortage has appeared in potassium perchlorate, a material used in flares, and its producers have agreed to supply military needs first. The commercial uses of this substance consist chiefly of fireworks, road flares and mine explosives where dynamite cannot be employed. The Pennsylvania Salt Company is building a new plant at Bonneville Dam, and present producers are expected to announce expansion plans soon. The situation here will be greatly improved within the next four or five months.

Production of oleum, a grade of sulphuric acid, used in the manufacture of smokeless powder and TNT, is being doubled through plant expansion. More capacity can be had from the petroleum companies whenever needed, and it would not take long to build additional facilities.

Toluol is another essential ingredient in TNT, and one that was difficult to obtain during the World War. This chemical is a by-product of the coke industry, and since only a small quantity is required for explosives in peace time, most of the toluol has found its way into the manufacture of commercial solvents. Processes have been developed whereby toluol can be made synthetically and on a large scale from petroleum.

The Humble Oil Company is building at Baytown, Tex., a toluol plant which will have a 30,000,000-gallon annual capacity. Operations there are scheduled to begin in August or September instead of November, as originally planned. The Shell Oil Com-

pany is starting production at its Houston refinery at the rate of 2,000,000 gallons a year. New by-product coke ovens being built for the steel industry will provide another 10,000,000 gallons of toluol. Still additional government-financed expansion may be necessary.

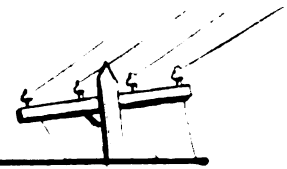
The du Pont Company has undertaken the manufacture of potassium cyanide--a strategic chemical employed in hardening tool steels. This chemical until now has been imported, but is no longer available. American raw materials will be used exclusively, and thereby another step is taken toward national self-sufficiency. * * * * *

The supply of alcohol appears to be more than adequate. Approximately 120,000,000 gallons were produced last year out of a potential capacity of 180,000,000. It is estimated that only 20,000,000 gallons will be directly used in defense this year, and defense authorities say another 50,000,000 capacity can be had if needed.

Glycerine, which was widely used in explosives in the World War, is no longer an essential, due to a recent change in formulas. In the World War, also, there was a pronounced shortage of cotton linters. * * * * *
Linters are no longer a problem,for a new material in the form of alpha cellulose, made from wood pulp, can be substituted whenever the supply of linters runs low.

Shortly before the United States entered the World War chemical prices began to skyrocket, and later some chemicals were not to be had at any price. So far in this emergency there has been little change in chemical prices. Meanwhile the industry has taken the country far down the road towards raw-material independence through the development of synthetic rubber, synthetic fibers that would help relieve a silk shortage, and many plastics for defense use and as substitutes for a multitude of civilian products.

CONCENTRATION



VERY LIGHT

THIN

AVERAGE

ADVICE TO DRAFTEES*

Col. A. J. Dougherty, USA-Ret

Our Army is proud of its traditions and will expect you to aid in keeping them clean. You must be, and keep yourself, physically fit, mentally alert, and keen, morally straight and clean. One basic aim of your leaders will be to give you a set of correct habits; and much of the drill and daily routine of your soldier life will be for this purpose--to inculcate in you correct moral, mental and physical habits. The habits which you will acquire in your year of service will also be of value to you in all your later life. You will be away from home; but gambling, drinking and loose women spell disaster to you even more quickly in the Army than they do at home. Pick friends who do not have these bad habits.

OBEY ORDERS. Listen carefully to all instructions; be sure you understand them and then carry them out absolutely. If you think some noncommissioned officer, or even an officer, has given you unfair orders or discrimination--obey the order first and then go to your superior through channels, with your complaint. *OBEY FIRST:* complain afterwards only if you feel compelled to do so. Generally it is better not to complain. No superior has the right to give you an order to disobey law or to ask you to do so, and I have never personally known such an order to be given.

Soon after arrival you will be issued a lot of clothing and military equipment. Take *IMMEDIATE* steps to put identification mark or number on every article issued to you; unless such article is already marked. Some things like rifles, for example, already have stamped on them numbers for identification; many companies prescribe uniform methods and locations for marking clothing and equipment. Prompt compliance with this paragraph will save you from loss of misplaced equipment which cannot otherwise be identified by you.

You must keep all clothing and equipment in neat and first class condition; such as shoes well polished, arms very clean

**Reproduced by courtesy of Yuma Daily Sun.*

and all metal free from rust, buttons sewed on, clothing neatly mended and free from all dust and spots. Arrange your clothing and equipment neatly at all times, and in the places and manner prescribed by the company commander or other superior authority.

You will be under the direct command of a corporal or squad leader. Do not hesitate to ask him for advice or information. Many instructions for you will be placed on the detachment bulletin board. Look the board over carefully every day. The habit of promptness may, on the battlefield, mean life to you and your comrades. No opportunity to assist in its formation is neglected; when directed to be at a given place at a given time you will be expected to be there at that time--and not ten seconds late. If the duty is in connection with others, your detachment will be formed promptly at the assembly time. Failure to be there on the dot is a cardinal sin. Don't forget it.

Do your best--*your VERY BEST*--any duty you are told to do. Tell the truth. The truth is always at a premium, and especially so in the Army where a man's life often depends upon the truthfulness of some comrade. A lie is always punished and the man telling a lie is disgraced. One of the aids in the formation of the habit of obedience to authority is the military salute. Learn when and where to salute, and make it accurately and with snap. And when you salute think: "I will obey authority promptly and cheerfully, because obedience is necessary to victory and may save my life." Be neat. Keep your hair properly trimmed; get a daily shave, or better,shave yourself daily; clean up promptly after work; keep fingernails clean, hair brushed, etc. These things are noted by your superiors and are the outward expression of inward worth. Write home regularly, at least once a week.

Take no more than five dollars with you, at most, when you go to camp. Five to six dollars a month will cover all your necessary cash expenses. The rest of your pay can and should be saved by you, and deposited each month,or pay day, with the army paymaster for the U. S. Government savings account, with liberal interest allowed to you. Do not borrow money or get credit from anyone. Don't go into debt,even to the post store called "post exchange". Live on a cash basis. Your savings will come in mighty handy at the end of the year. Conversely, do not lend money to anyone. You will need a small compact sewing kit. If not issued to you,buy one at the post exchange.

Spend a part of each day at study. Your corporal will be glad to lend to you a copy of his drill regulations or other manual covering your current military work. In the winter, each post runs an afternoon or evening school which you can enter and which will teach high school and even some college subjects. There will also be schools in many places, covering

auto mechanics and other forms of manual training. Do not let the much-advertised "army discipline" worry you. You won't be shoved around just for the pleasure of it. There will be a reason behind everything you are told to do. Discipline, in the Army, is the process and routine by which you acquire vitally important military habits. Now, habits are formed by repetition over any extended length of time and they are transferable. For example, snap may save your life on the battlefield; by performing movements of drill with snap thousands of times over many months you acquire the habit of doing things quickly, and this may save your life and the lives of your comrades. Hence, it is important. Do not resent being ordered to do things, nor the corrections you receive. The men now giving you orders had to go through the same instructions themselves. When you make good, you, in your turn, may be called upon to exercise command.

* * * * *

Patrick Henry saw no way of judging the future but by the past. We can do better than that. We can judge the future by the present. We know that our safety, and the safety of all that we hold dear, depends in arming to the hilt, and staying that way until the peril has passed. That is just what we are doing. The defense program is a national program. It is a forty-eight state program. It is a two-coast, two-border, two-ocean program. It is a job for all of us, everywhere.

- *Hon. Robert T. Patterson*

* * * * *

Aerial view of cantonment area, Edgewood Arsenal, as it appeared January 14, 1941

RAILWAY PREPAREDNESS FOR WAR

Lt. Col. G. M. Sixsmith, ORD-Res*

(EDITOR'S NOTE: As the activities of the several War Department Procurement Districts become less theoretical and more realistic, the importance of transportation becomes increasingly apparent. This address, by a leading transportation expert on the broad aspects of transportation in war, is therefore reproduced as a matter of general interest.)

These are *very* serious times and any discussion involving preparedness should, I believe, be undertaken only in an accurate, careful, and serious manner. There should be no opportunity for misunderstanding.

When Mr. E. W. Smith, Vice-President of The Pennsylvania Railroad, was asked by Colonel Ditto,** through John McKirdy, Chemical Warfare Service, to provide a speaker to deliver a message on railroad transportation at this meeting, the request was considered a striking and definite compliment to the railroad industry.

This meant to us that the importance of transportation, not only in peace times, but particularly at this time when we are facing an emergency, is being given the consideration it merits by the agencies of our Government responsible for the success of the preparedness program, and that they are recognizing the fact that adequate transportation is one of the important component parts of any industrial program if that program is to be the success it must be.

Therefore, in the coming emergency, involving as it will large industrial expansion and production, the railroads of

* *Colonel Sixsmith is superintendent of the Conemaugh Division of The Pennsylvania Railroad. He delivered this address before a group of Reserve officers at Mellon Institute, Pittsburgh, October 10, 1940. - Ed.*

***Colonel R. C. Ditto is executive officer of The Pittsburgh Chemical Warfare Procurement District.*

this country are going to play an important part,and we in the railroad industry are glad to know Colonel Ditto and his associates in the various services recognize this fact,and we want to be assured that the railroads *are prepared.*

After an interval of some years the World is again at war. Nations across the Atlantic have been wiped out, *largely because of lack of preparedness,* while surviving peoples live in fear of bombs and death, also because of lack of preparedness. Today no country knows when it will feel the hot breath of the invader, and our own great land, once thought far removed from Europe's turmoil, is frantically arming for defense.

This means transportation - transportation on a large scale - and with defense uppermost in the minds of most Americans it is only natural that we in the railroad industry are being reminded that transportation is a vitally important factor in the conduct of offensive or defensive military operations. The problem of the use and misuse of transportation in times of peace and particularly in times of war is an extremely important one.

Any approach to that problem must take into consideration what happened before, and after,the entry of this country into the last World War.

The record of 1917 is not a pleasant one to review. Hysteria prevailed as war was declared. Our coastal ports and supporting terminal tracks were blocked with cars loaded with materials for transport, and no ships available.

Miles and miles of tracks leading to the eastern seaboard, and on the eastern seaboard,were occupied with motionless cars of freight, held back until it was known definitely when vessels for transshipment would be available. Storage space for raw materials and partly finished products was at a premium.

This congestion was due to the shipment of materials and supplies far beyond the ability of the receivers to absorb;the loading of cars with vast exports without consideration of the availability of ocean shipping; and the legal requirement that government freight be given preference in movement without regard to the ability to unload promptly. The records show that in the eastern territory alone more than 200,000 railroad cars were tied up under load and were being used as storage houses on wheels.

Those 200,000 cars would absorb about 1800 miles of tracks and terminals, and reduce the capacity of the entire railroad system by probably 25 percent. It was not until this situation was under control, and the introduction or the permit system, with strict adherence to its application, that some semblance of order and efficiency in transportation was possible. This was finally brought about through the cooperation of all interests concerned.

A great many strange things happened in those hectic war

days, some of which I believe will be of interest to recall.

In some cases shipments were consigned to a boat not yet launched in the shipyards, a boat to be built and named as the keel was laid.

Anchors were forged and shipped to boat building yards for use on vessels the construction of which had not yet been started.

Thousands of cars were loaded with coal for export and started from the mines on their rail journey towards the water front, long before there was any hope of securing boats for transfer from rail to water transportation.

These cars had to be held under load somewhere - and they were so held - many of them for months.

As it became necessary to move up cars containing essential material that were "buried" on side tracks among cars containing products not immediately needed, the digging out of such cars for further movement was a burden that hindered an efficient and free transportation service.

In fact it was not unusual to lift out such cars with derricks,where this could be done with greater speed and less interference in railroad operation.

You must remember that 25 years ago railroad equipment,both locomotives and cars,was of materially less capacity. Railbeds with light rails were in the majority. Light locomotives were used, and this condition could not be improved until roadbeds and bridges were strengthened to sustain heavier equipment.

At that time,little attempt had been made to handle freight traffic on a definitely scheduled basis. Through train movement consisted of a string of cars destined to the next division terminal or beyond. Such trains were operated when tonnage was available.

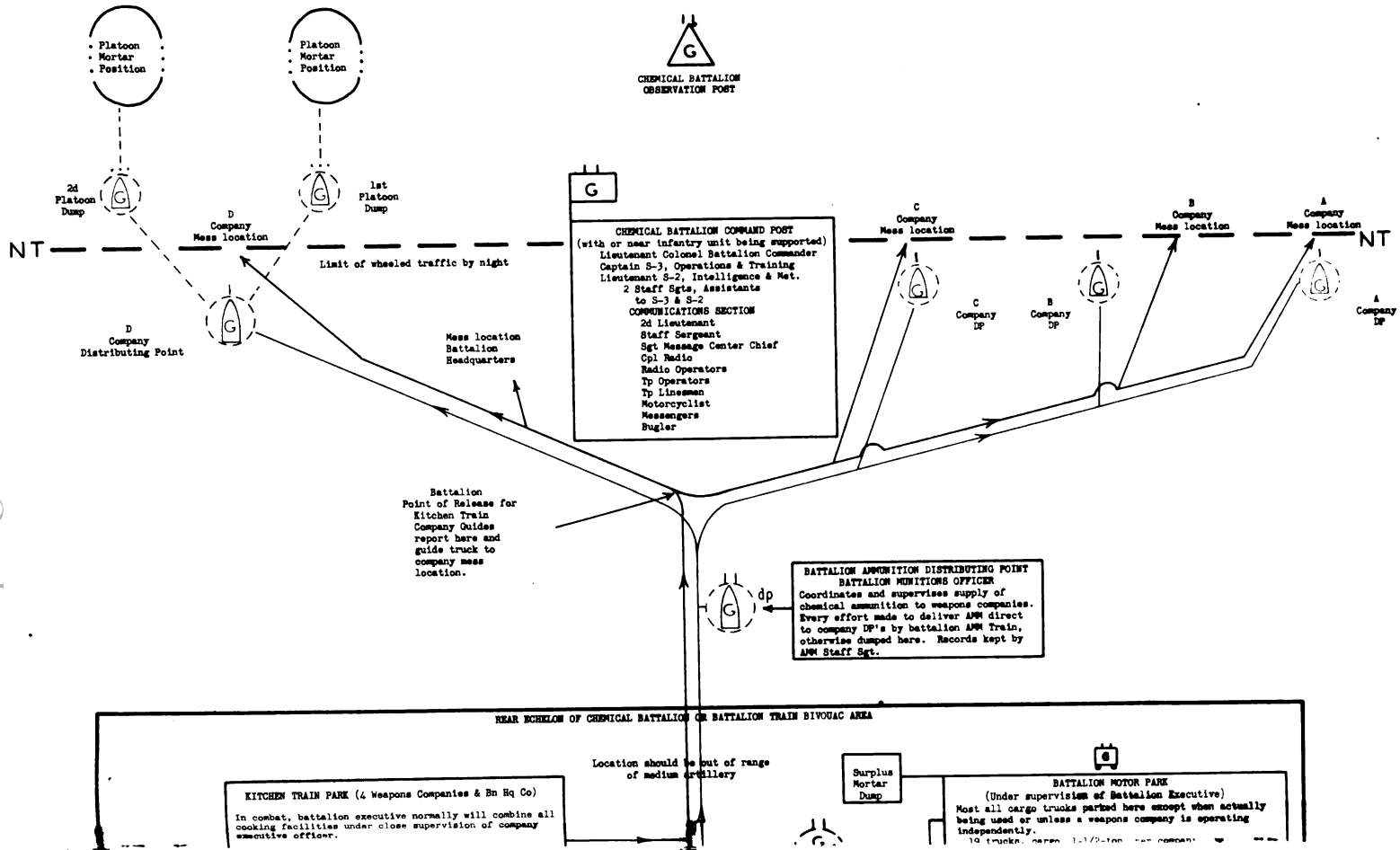
The factor of hysteria was ever-present. Shippers and consignees alike believed there would be a car shortage - and did everything possible to contribute to it. Shippers wanted to get their orders on wheels so they wouldn't be subject to cancellation. Receivers of freight insisted that it be placed in transit,despite the fact that there were no facilities for unloading.

The railroads, the public and the war and navy departments were having their first taste of war on a large scale.

In the absence of advance preparation and organization to meet such a situation, it is not surprising that many mistakes were made.

And the railroads made their share of those mistakes, but I'm sure you will agree with me that the railroads did not break down as transportation machines in 1917. The breakdown came as a result of the use of the railroads for storage purposes, and not as vehicles of transportation.

Now no person thinks there will be a repetition of the



20 Cooks - 15 cook helpers
Necessary K.P.'s

W dp

WATER SUPPLY

SERVICE STATION
Gas and Oil Distributing Point.
Supervised by S-4.
Sergeant from Bn Hq Co in charge.

80 trucks may be parked here.

BATTALION AMMUNITION TRAIN
Commanded by Munitions Officer
16 trucks, cargo, 1-1/2-ton.
16 trailers, 1-ton.
1 motorcyclist.
Organized into 4 sections each having 1 Sgt,1 Cpl & 8 men.

MOTOR MAINTENANCE SECTION
Under S-4
1 Master Sgt, 1 Staff Sgt, 1 Clerk Cpl.
8 Motor mechanics

SUPPLY OFFICER'S GROUP

REAR ECHELON OF THE 4 WEAPONS COMPANIES
SUPPLY AND PERSONNEL FUNCTIONS

EX OFFICERS (1ST LTS)	FROM	EACH	WEAPONS	COMPANY
1ST SERGEANTS	"	"	"	"
SUPPLY SERGEANTS	"	"	"	"
COMPANY CLERKS (CPL)	"	"	"	"

HQ G

HEADQUARTERS & HEADQUARTERS COMPANY
Major, Battalion Executive - Commands Bn Train Bivouac

COMPANY HEADQUARTERS	STAFF SECTION	SUPPLY SECTION
Captain Company Commander, Adjutant, S-1 (Personnel)		1st Lieutenant S-4
1st Sergeant Mess Sergeant Supply Sergeant 1 Clerk Cpl Company Mechanic Orderlies	Bn Sgt Major, Master Sgt Personnel Sergeant Major Camouflage & Gas Corporal 2 Clerks 1 Stenographer	Technical Sergeant Supply Corporal Clerk Motorcyclist

RECEIVING - DISTRIBUTING
GROUP
FOR ALL SUPPLIES
EXCEPT CHEMICAL AMMUNITION

ARMY SERVICE AREA
Location should be out of range of artillery

XXXX XXXX XXXX XXXX XXXX

O E S Q

ORDNANCE MEDICAL ENGINEER SIGNAL QUARTERMASTER

ARMY BRANCH DEPOTS
SOURCE OF CLASS II AND IV SUPPLIES

Note: Gas and Oil Supply Points near all depots or en route thereto.

GAS & OIL CLASS III SUPPLY POINT

rhd

RAILHEAD
OF UNIT TO WHICH CHEMICAL TROOPS ARE ATTACHED
SOURCE OF CLASS I SUPPLIES-RATIONS

XXXX G

ARMY CHEMICAL WARFARE DEPOT
SOURCE OF CWS WEAPONS
and Chemical Weapons Ammunition Class V
also
CWS Supplies for all Troops
Class II and IV Gas Masks
Protective Equipment

dp

AMMUNITION SUPPLY POINT
of Unit to which chemical troops are attached.
Source of small arms ammunition used by chemical warfare troops.

SCHEMATIC LOCATION
OF SUPPLY POINTS FOR
SEPARATE CHEMICAL BATTALION
(MOTORIZED)

Red lines indicate ammunition supply installations and ammunition flow.
Blue line, all other supplies.

Prepared by:
Department of Extension Courses,
Chemical Warfare School.
1941

troubles encountered during that hectic period. The sort of things I have just enumerated won't happen again. There is no need for them happening again, and there are many reasons why.

They won't happen again because we have all profited by those war experiences of many years ago,and there are now well developed plans for cooperative action between governmental departments and the railroads.

They won't happen again because the railroads themselves are organized in a way that will insure a maximum of efficiency in operation, and a maximum use of power and equipment.

They won't happen again because we now have a shipper-carier cooperation in this country - a cooperation in every sense that the word implies.

And above all, they won't happen again because there is a vastly improved transportation system in this nation today.

But before going into that phase, let us turn for a moment to the problem the railroads face in our national defense program.

All of you have heard or read a great deal about the extensive preparations now under way, and I would like to analyze them,so far as possible in the light of information obtainable up to this time, and see what relationship they have to the normal commercial traffic.

Let us assume that this preparedness program will involve the additional production of 10 million tons of steel, including both Army and Navy programs, as well as industrial plant expansion, and that the program will be carried out over a period of two years.

Including raw materials and finished products this will involve a movement of approximately 1,013,000 carloads.

Spread this out over a 2 year period and it will amount to an average of less than 9800 cars per week, or 1½ percent of the average weekly carloadings in 1939.

To maintain one million troops,it is estimated that maximum requirements, including food, clothing, arms, ammunition, and all other materials, would aggregate five and a half million tons per year, an average of 3900 carloads per week, or about six-tenths of one percent of the average weekly carloadings in 1939. For three million men, the maximum requirements for one year, would average 11,750 carloads per week, or 1.8 percent of the average weekly loadings in 1939.

In all, then,the increased annual steel output, maintenance of three million troops, and material for camp construction, would involve an average rail movement of about 25,400 carloads per week, or about four percent of the average weekly carloadings in 1939.

Now, for good measure, let us double those figures, and we have 50,800 carloads per week, an average that is less than eight percent of the average weekly loadings in 1939.

An increase of less than eight percent, as you can readily see, offers no great problem to the railroads. It is assumed that this additional traffic would move more evenly throughout the year than the ordinary commercial traffic, and this would give the railroads business at times of the year when, under normal circumstances, they have a great surplus of capacity, and that brings us down to the question heard so often since the outbreak of the European War: "Are the railroads of our nation prepared?"

The answer is an emphatic "Yes!" and I will tell you why.

Meeting in April, 1923,the railroads decided to embark upon a great program of rehabilitation and improvement of railroad tracks, structures, rolling stock and equipment of all kinds.

In short, it was decided at that time to build into the railroads the capacity necessary to handle the business without congestion, delay or "car shortage".

As a result of the superb carrying out of the program then inaugurated, since 1923 there has been no such thing on American railroads as a general car shortage - although in eight consecutive years the freight traffic handled exceeded that of the war year of 1918 by from one and a quarter to eight and a half million cars a year.

How was this result obtained? It was obtained by the more efficient use of better and bigger cars, pulled by faster and more powerful locomotives, and the use of a vastly improved railroad plant.

Because of this better railroading on better railroads, the record traffic of 1929 - which was more than eight million cars above that of 1928 - was handled without congestion, delay or car shortage, although the railroads had 60,000 fewer cars and 5,600 fewer steam locomotives than they had in 1918.

And such have been the gains in efficiency and service even since 1929, that the heavy traffic of that year could be handled today with 350,000 fewer cars than were used then.

These great gains in railroad capacity and efficiency could not have been achieved without large investment of capital in better railroad plant and in better and bigger equipment.

In the eight years after 1922, the average expenditure for capital improvements was nearly 843 million dollars a year.

In the succeeding eight-year period, 1931 through 1938, the average was about 259 millions a year - or a total of some ten billion dollars in that period.

In short, *the railroads have been largely remade during the past 20 years.*

This money has been spent not only for new or completely rebuilt cars, and for new or modernized locomotives, but for straightening and strengthening tracks, for building stronger bridges,for improving yards and terminals,for better shops and signals,and for hundreds of other railroad improvements of the

sort which add to railroad capacity, improve service, increase safety, and reduce expense.

And now for the results -

Freight cars of today have an average carrying capacity eight tons greater than they had in 1918.

Freight train speed averages 64 percent faster than it was in 1920.

The freight train of today performs twice as much service per hour as it did in 1920.

Locomotives have an average of 43 percent more pulling power than in 1918.

Output transportation per train, as measured by tons moved one mile in one hour, has increased 116 percent since 1920.

The Pennsylvania Railroad, with which of course I am most familiar,in the last ten years has added to its equipment more than 31,500 new freight cars and 332 new locomotives, all of the most recent types and designs; and in the last two years, all the railroads of the nation have added at least 100,000 new freight cars.

In the last seven years the Pennsylvania has practically doubled the average load per car of less-than-carload-freight. In 1939 this saved the loading and movement of more than 560,000 cars in merchandise traffic. Every car thus released from merchandise service became available for carload work.

What is not generally realized, I believe, is the fact that the railroads in their every-day work are thoroughly experienced in handling mass movements of civilian passengers, and that these movements are larger in volume than any individual movement which seems likely to be required in the building up of a huge Army.

Never before have I seen the time when the thousands of railroad employees were as anxious as they are today to handle successfully any transportation load that may be placed upon them. Therefore, I am certain, as are all other railroad officers, that this load will be carried to the satisfaction of all.

That leads me to again say "Yes - gentlemen - the railroads are ready". I am sure time will prove the accuracy of that statement.

And now - in the words of the late General Leonard Wood - "when the lights go out it is time to go to bed".

In the early months of the World War - when General Wood was commanding officer of the Eastern Department, with headquarters on Governors Island, there was received at his headquarters a telegram from the officer in charge of a troop train moving somewhere in the middle west - several hundred miles away - reading like this -

"Last night the lights in one of our cars went out - please have them fixed for tonight."

In some manner that telegram reached the hands of General Wood who directed that the gentleman be told that "when the lights go out it is time to go to bed" and this became a catch phrase in Army circles.

I am quite familiar with the authenticity of that episode, because it was I who dispatched the message for General Wood, and the stenographer who wrote it is in this audience tonight.

And so, for me at least, the lights are out, and it is time to say "Good-night".

* * * * *

GASES AND CHEMICALS

The United States is not a party to any treaty, now in force, that prohibits or restricts the use in warfare of toxic or nontoxic gases, or of smoke or incendiary materials, etc. A treaty signed at Washington, February 6, 1922, on behalf of the United States, the British Empire, France, Italy, and Japan (Malloy, Treaties, vol. III, p. 3116), contains a provision (art. V) prohibiting "The use in war of asphyxiating, poisonous or other gases,and all analogous liquids, materials, or devices", but that treaty was expressly conditioned to become effective only upon ratification by all of the signatory powers, and, although heretofore ratified by all of the signatories except France,having never been ratified by the latter, has never become effective. The protocol "for the prohibition of the use in war of asphyxiating, poisonous, or other gases, and of bacteriological methods of warfare", signed at Geneva June 17, 1925, on behalf of the United States and many other powers (League of Nations Official Journal,Aug. 1925,p. 1159), although ratified or adhered to by, and now effective as between, a considerable number of the signatories, has never thus far been ratified by, and is not in force as to, the United States, Japan, and some other powers.

- FM 27-10 (Rules of Land Warfare).

* * * * *

ATTACK

U.S. ARMY SIGNAL CORPS

HORSES IN CHEMICAL WARFARE*

Capt. Don L. Mace, Veterinary Corps

The role of the horse in future conflicts is a much discussed question, yet military authorities agree that warfare on difficult terrain requires the use of animal units as important elements in defense, offense, and supply. In spite of the undoubted efficiency of modern automotive equipment, there are conditions in war under which such equipment cannot operate, and animal drawn and pack transportation,along with horse cavalry, appear to be the approved solutions.

Richters, in his book *Animals in Chemical Warfare*, observes that, "The laboratory experiments carried out during the war, as well as experiences in the field compel us to recognize that, although war gas poisonings in the case of horses do not end fatally, so often as in the case of man, nevertheless, man and animal are on the same plane as regards susceptibility to war gases. In fact, as regards certain substances, e.g. mustard gas (yellow cross) the horse,particularly his skin,proves to be more susceptible than man. It is only to a single group of war gases, the lacrimators, that the horse has a relatively high degree of immunity."

War experience indicated that animals are less sensitive to irritant smokes than man, and it can therefore be assumed that suspended particles of these arsenicals in low concentrations do not exert severe irritating action upon the eyes and respiratory passages of animals. With medium concentrations,the action upon the animal organism is considerable. With the high concentrations, there is a copious flow of tears, a spasmodic cough, nasal discharge, and labored breathing. In 15 to 20 minutes,the intense pain and symptoms begin to subside, and disappear in 1 to 2 hours without leaving permanent injury. Similar observations are reported by Szablowski. It appears possible that it may not become necessary to evacuate or treat horses following exposure to these relatively nonpersistent

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agents, and that they can be put to work almost immediately after exposure.

It is generally believed that the horse is not affected by lacrimators. While many conflicting theories have been advanced by different observers explaining this lack of equine susceptibility, it is the opinion of the author that the intolerable concentration for lacrimator gases is higher for the horse than for man, and that average field concentrations do not have a very noticeable effect upon horses' eyes.

Very reactive substances such as chlorine, or those which have a tendency to hydrolyze rapidly in the presence of moisture, will cause marked injury to the mucous membrane of the upper respiratory passages. Gases, however, which hydrolyze more slowly (phosgene) penetrate the lower respiratory passages rapidly and gradually exert their effect, but cause less damage to the upper parts of the air passages.

Within two minutes following exposure of the horse to large doses of chlorpicrin, Soshestvienski observed serious nasal discharge, licking, abundant salivation, and eye irritation evidenced by the horse partly closing his eyes; after 10 minutes there was an acceleration of respiration,coughing, retching, weak heart action,and a slight rise in temperature. With passing of time, these symptoms became more pronounced in severity and the horse died in a state of general weakness, difficult breathing, and weak heart action. In weaker concentrations, symptoms begin to appear in about 10 minutes,which consist of blinking of the eyes, salivation, serious nasal discharge, restlessness, coughing, dyspnea, and accelerated weak heart action; coughing up of foamy liquid, and a slight rise of temperature are also noted, and pulse and respiration are increased. The crisis is generally reached eight hours after intoxication, followed by a change for the better.

Phosgene is more toxic than chlorine, and its physiological action differs in that it affects the lower part of the lungs to a greater extent than the upper respiratory passages. The effect is cumulative and in exposures to low concentrations over extended periods of time it will cause acute pulmonary edema, perhaps by hydrolysis within the lung tissue and the formation of hydrochloric acid.

According to Szablowski, horses poisoned by low concentrations of phosgene develop areas of edema in the lungs, the animals appear listless for 15-18 hours, and the temperature rises as high as 102.2°F., where it may remain for as long as 12 hours, returning to normal in two days.

Severely gassed patients may suffer from circulatory collapse as shown by the grey pallor, a rapid feeble pulse, and by venous congestion and dilatation of the right heart (never of the left). The circulatory collapse is aided by the following conditions: the local condition of the lungs; by a com-

pression of the capillaries and veins resulting from edema of the lungs;and by the increased viscosity and thrombosis of the blood caused by the transudation of plasma into the lung tissue, thereby reducing the more fluid portion of the circulating blood

Even light physical exertion is harmful to animals gassed with phosgene or other lung irritants, since it places additional work on an already overtaxed heart, and causes a greater demand for oxygen. Exposure to concentrations of phosgene high enough to cause sudden death will rarely occur,unless the animal is in the immediate neighborhood of a gas-shell burst. In such an event, destruction of the respiratory epithelium occurs, and death is caused by asphyxia as a result of rigid contraction of the bronchi.

First aid and treatment applicable to lung-irritant gassed animals should consist of some of the following measures:

a. The first and most important procedure is evacuation to uncontaminated areas. This should be done in such a manner as to avoid undue exertion by removing pack, harness, etc., and evacuating at a slow walk. Warm coverings should be used in cold weather. Because of the delay in the appearance of symptoms, phosgene gassed animals may appear in good condition even though they are seriously injured, a condition which may not be evident until a few hours after gassing. If animals are allowed to exert themselves during this period, recovery may be made more difficult.

b. Casualties should be kept quiet, supplied with plenty of fresh air and water, kept warm and out of draughts,supplied soft foods, and allowed individual stalls with suitable bedding free of dust.

c. Oxygen may be administered either by mask, by subcutaneous injection, or by intravenous injection as advocated by Richter.

d. Nonalcoholic stimulants are indicated and expectorants may be used advantageously.

e. Morphine and like depressants are contra-indicated.

f. Eye irrigations with boric acid or weak salt solutions should be useful in cases with eye irritation.

Mustard gas and lewisite are the principal vesicant war gases at the present time. Mustard gas became a most important chemical-warfare agent in the World War due to the difficulty of providing protection against it. The gas mask, when properly used, gives complete protection to the lungs and eyes of man against vesicant agents, which also attack any part of the body with which the liquid or vapor comes in contact. It is not only a highly vesicant substance, but also a powerful lung irritant. Unlike chlorine and phosgene,it does not cause extensive lung edema but attacks the whole respiratory system, producing inflammation of the trachea and bronchi with necro-

sis of the mucous membranes and development of secondary bronchitis or bronchopneumonia. This agent has no immediate irritant action on the peripheral nerve endings,consequently there is no pain evident for several hours after exposure.

There are few discussions in the literature concerning mustard injury of the eye of the horse, and the available discussions come mostly from World War experience. Mustard exerts a degenerative and necrotic action on the cornea.

Treatment of the eye should consist of long continued irrigation with lukewarm aqueous solutions of sodium bicarbonate, which may aid in removing any uncombined agent which may be present. Irrigations with boric acid solution aid in preventing some of the secondary infections which follow eye burns. Cod liver oil or bland lubricants may be applied to the corner and lids of severely burned eyes. Animals should be kept in dark stalls. Use of 1 percent creolin ointment about the margin of the eye is useful in keeping flies away.

Through the swallowing of forage and water contaminated with vesicants,corrosive action upon the alimentary mucosa may be produced, varying from a catarrhal inflammation to large areas of eschar formation that may result in rupture. Richters repeatedly observed injuries in animals pastured on mustard poisoned terrain from consuming contaminated forage or water. The entire alimentary tract along which such material passed exhibited inflammation, erosion, and formation of ulcers. Inflammation and swelling of the mucous membrane of the mouth occurred along with the formation of typical mustard vesicles. The injury to the gastrointestinal tract is manifested by a thin, watery blood-tinged diarrhea, and emaciation accompanied by great debility. Treatment of these alimentary effects should follow general symptomatic measures.

The degree of injury from exposure of the respiratory passages to mustard presents a whole series of intensities, depending upon the size of dose and the duration of action. There is no special method for the treatment of horses poisoned by mustard through the respiratory tract,and such procedure is purely symptomatic. The nasal passages may be washed with a solution of sodium bicarbonate or boric acid in an effort to remove any residue of mustard which may be present.

The sensitivity of the skin of the horse is about the same as that of man; however, there are portions of his body that probably are more sensitive. These are the cleft of the frog, the coronet, the bulbs of the heels, the posterior portion of the pastern, the axillae, the inside of the thigh, the sheath, the perineum, the genital organs, and other portions denuded of hair.

A very slow rate of healing is characteristic of mustard gas injuries and first aid treatment should be employed to shorten the healing time. The success of such treatment de-

pends upon the speed with which it is used after exposure, the best method being one which can be applied easily and quickly, since such measures will not prevent injury if attempted later than 10 minutes after contact with mustard. The longer the treatment is delayed, the worse the injury will be.

When contaminated animals have to be treated, the attendants must wear respirators and protective clothing. The tail should be secured by tying or holding, and the saddlery and harness, which is probably contaminated, should be removed. When contamination is widespread and is not accurately defined, the animal should be completely and vigorously scrubbed with soap and water. Warm water, soda, and soft soap are usually convenient and are satisfactory. Plenty of water should be used and the washing continued for 20 minutes. Weak solutions of chloride of lime are reported valuable for rinsing, and potassium permanganate solutions are somewhat effective in neutralizing mustard gas on contaminated animals by oxidation. The skin should be thoroughly scrubbed with a paste made of freshly prepared bleaching powder and water, care being taken to avoid the eyes, nostrils, and lips. Bleach-paste is irritant, and should not be left on the animals longer than 5 minutes; it can be removed by flushing with water. Weaker solutions may be applied for longer periods.

Where contamination is local and clearly defined, the visible drops should be removed mechanically with cotton, wool, waste, or rags, care being taken not to spread the contamination to the surrounding parts. Destroy immediately by burning any material used in mechanical removal of the agent. In some cases it may be advantageous to swab these areas with solvents such as gasoline or kerosene. It must be remembered that the agent is merely diluted with these solvents and is not destroyed, and that care should therefore be taken not to spread the contamination to surrounding parts when swabbing with solvents. Neutralization of the contaminant should be performed with the same agents as listed above.

Treatment of gas cauterized areas to prevent secondary infection can be accomplished with moist Dakin's solution packs. Zinc paste or petrolatum may be used about the margin of wounds to prevent blistering from exudates.

Lewisite lesions are more severe than those from mustard, and the burns are immediately painful. In addition, there are systemic effects from absorption of arsenic. In the presence of moisture lewisite hydrolyzes to form a nonvolatile oxide. This one great disadvantage leads to the belief that it will not be used extensively in coming wars.

When animals are burned by particles of phosphorus the first thing which should be attempted is to exclude air from the affected parts. Such temporary measures include the application of mud or water,followed preferably by 2-5 percent cop-

per sulfate solution, which coats over particles of phosphorus and prevents their burning action until the particles can be manually removed.

In affording individual protection to horses, attention has been directed mostly to the lungs and hoofs. During the World War the Americans developed horse gas masks that gave some lung protection. Horse boots were also devised and used during the World War to protect the hoof and lower leg. However,neither mask nor boots were considered highly satisfactory.

Animals should be prevented from pasturing in localities or drinking from water holes, trenches, or shell craters in areas which have recently been contaminated with gas. It can not always be determined by sight or smell whether suspected water and forage is contaminated with gas. Water may sometimes have a film of mustard gas upon its upper surface which can be detected by sight or smell. In case plants and grasses have been contaminated by mustard gas, lewisite, chlorine, or phosgene, this condition might be recognized by a peripheral withering of the foliage or by drying of the shoots.

It is the author's belief that forage and water moderately or heavily contaminated previously by vesicant gases or irritant smokes should not be consumed by the horse. British and Roumanian authorities apparently support the views of Richters, who contends that oats contaminated by mustard gas can be made fit for consumption by washing thoroughly with hot water; and that hay, after mild exposure to mustard vapor, can be decontaminated if it is exposed in thin layers to the action of the sun and aired thoroughly by turning frequently for at least 1 day. This same procedure should be satisfactory on forage following exposure to field concentrations of chlorine, phosgene, and diphosgene. Forage contaminated with chlorpicrin can be decontaminated by exposure to air, but chlorpicrin is stable to heat and hydrolysis. Forage contaminated with lewisite, diphenylaminchlorarsine, and diphenylchlorarsine should be destroyed, since it cannot be decontaminated by exposure to air or water. Forage is best protected by impervious coverings or by storage in air-tight shelters when in areas likely to be contaminated by gas.

In contaminated areas water should be withheld from animals until suitable tests have demonstrated the absence of injurious agents. Water in large running streams, deep wells, or large lakes where the factor of dilution is great, can usually be regarded as nontoxic.

CURRENT COMMENT

Gas Defensive Appliances.

The War Department has announced that contracts to the total of approximately $10,000,000 had been negotiated by the Chemical Warfare Service in connection with its projects for procurement of gas mask charcoal and other chemicals used in gas defensive appliances.

Following is a list of firms participating in these projects:

National Carbon Co., New York City.
Barnebey-Cheney Engrg. Co., Columbus, Ohio.
Atlas Carbon & Clay Co., Glendale, Calif.
Carlisle Lumber Co., Seattle, Wash.
Dewey & Almy Chemical Co., Cambridge, Mass.
Carbide & Carbon Chemical Corp., New York City.
E. I. du Pont de Nemours & Co., Niagara Falls, N. Y.
Monsanto Chemical Co., St. Louis, Mo.

It was pointed out that more than half of the total amount involved is to cover the cost of construction of certain plants which will be owned by the Government, though built by the firms concerned on a cost-plus-fixed-fee basis. The companies concerned in these projects are the Monsanto Chemical Company, the new plant of which is to be located at East St. Louis, Ill.; the Dow Chemical Company, and E. I. du Pont de Nemours & Co. On completion of plants they will be operated by the companies.

None of the projects involves injurious chemicals, the manufacture of which would constitute danger to persons residing in the vicinity of any of these factories. It was pointed out that modern gas masks and other gas defensive appliances involve the use of certain materials for which there is little or no commercial need, but which are required in quantity to meet the national defense program.

Noncombatant Gas Masks.

The War Department also recently announced the placement of orders by the Chemical Warfare Service with five commercial establishments for the manufacture of a limited quantity of

low-cost gas masks known as "noncombatant masks". This type of mask was designed to meet the requirements of a military commander in providing gas masks for noncombatants remaining in areas under military jurisdiction and control. The noncombatant gas mask, however, is of a type which the War Department believes would be suitable for general civilian use. The mask provides protection against all known gases in the same manner as does the service gas mask issued the troops, but is not designed for the long life and rugged use of the service gas mask.

The educational orders for noncombatant gas masks were made for the purpose of providing a limited quantity of noncombatant type masks and also by way of developing sources of supply for these masks should they be required in any considerable number. At the present time,no further extension of the manufacturing facilities for these masks is contemplated. The companies to which the educational orders have been given are the following:

The Kemper-Thomas Co., Cincinnati, Ohio.
Sprague Specialties Co., North Adams, Mass.
Eureka Vacuum Cleaner Co., Detroit, Mich.
Pittsburgh Store & Fixture Co., Blairsville, Pa.
B. K. B. Co., Los Angeles, California.

Chemical Advisory Priority Committee.

E. R. Stettinius, Jr., director of the Division of Priorities of the Office of Production Management, has appointed a Chemical Advisory Priority Committee. This committee functions within the framework of the division's administrative groups.

Col. Harrison E. Howe, CWS, was named chemical priorities executive and chairman of the Chemical Priority Committee. The other members are Warren N. Watson, executive secretary of the Manufacturing Chemists' Association, representing the producers; Ernest T. Trigg,president of the National Paint,Varnish, and Lacquer Association,representing the industrial consumers; Major C. V. Morgan, representing the Army; Lieutenant N. S. Prime, representing the Navy; Frank C. Whitmore, Dean, School of Chemistry and Physics, Pennsylvania State College, special technical consultant; and David P. Morgan, consultant from Production Division.

Technological Civil Protection Committee.

The Secretary of War, the Honorable Henry L. Stimson, has announced the appointment of four additional distinguished engineers to the National Technological Civil Protection Committee, formed recently to assist the War Department in collecting, evaluating and disseminating information concerning the protection of civilians and vital civilian installations in

time of war.

The new members are:

Mr. E. M. Hastings, American Railway Engineering Association, of Richmond, Virginia.

Mr. W. Cullen Morris, American Gas Association, of New York City.

Mr. John C. Parker, electrical engineer, New York City.

Mr. Frederick G. Frost, American Institute of Architects,of New York City.

Mr. Walter D. Binger, of New York City, representing the American Society of Civil Engineers,is chairman of the National Technological Civil Protection Committee. Other members, besides the new appointees are:

Mr. W. H. Carrier,American Society of Heating and Ventilating Engineers, of Syracuse, New York.

Mr. Harry E. Jordon, American Waterworks Association, of New York City.

Mr. A. B. Ray, American Institute of Chemical Engineers, of New York City.

Mr. Abel Wolman, American Public Health Association, of Baltimore, Maryland.

Mr. James L. Walsh, American Society of Mechanical Engineers, of New York City.

Mr. Scott Turner, American Institute of Mining and Metallurgical Engineers, of New York City.

In announcing the appointments, Mr. Stimson said that the Committee had already justified its creation. He stated, for example, that a booklet on protective construction, concerning air raid and other types of shelter to protect civilians in wartime, had been reviewed for the War Department by the committee through its constituent organizations, particularly, in this instance, by the American Society of Civil Engineers. This booklet, which is well on the way to completion and will be published shortly, was prepared by the War Department with the assistance and advice of other Federal agencies.

Several papers dealing with other phases of civil protection are being reviewed at present by members of the Committee.

It is also announced that persons desiring further information on civil protection will find it available for reference at the British Library of Information, Rockefeller Plaza, New York City. Documents available are:

ENGLISH

A.R.P. HANDBOOK No. 1.------- Personal Protection Against Gas.
A.R.P. HANDBOOK No. 2.------- First Aid and Nursing for Gas Casualties.
A.R.P. HANDBOOK No. 3-------- Medical Treatment of Gas Casualties.
A.R.P. HANDBOOK No. 4.------- Decontamination of Materials.

A.R.P. HANDBOOK No. 5.------- Structural Precautions Against Bombs and Gas.
A.R.P. HANDBOOK No. 6.------- Air Raid Precautions in Factories and Business Premises.
A.R.P. HANDBOOK No. 7.------- Anti-Gas Precautions for Merchant Shipping.
A.R.P. HANDBOOK No. 8.------- The Duties of Air Raid Wardens.
A.R.P. MEMORANDUM No. 1.----- Treatment of Casualties, and Decontamination of Personnel.
A.R.P. MEMORANDUM No. 2.----- Rescue Parties and Clearance of Debris.
A.R.P. MEMORANDUM No. 3.----- Organization of Decontamination Services.
A.R.P. MEMORANDUM No. 4.----- Air Raid Wardens.
A.R.P. MEMORANDUM No. 5.----- Anti-Gas Training.
A.R.P. MEMORANDUM No. 6.----- Local Communications, and Reporting of Air Raid Damage.
A.R.P. MEMORANDUM No. 7.----- Personnel Requirements for Air Raid, General, and Fire Precautions Services, and the Police Service.
A.R.P. MEMORANDUM No. C5.---- Air Raid Precautions for Docks, Wharves, Quays and Waterside Warehouses.
A.R.P. MEMORANDUM No. C6.---- Air Raid Precautions for Collieries.
Departmental Commission of Fire Brigade Services. Report. (Home Office) Cmd. 5224.
Fire Protection--Hints to Householders.
Fire Precautions in Schools.
Fire Precaution--Requirements in Theatres and places of entertainment.
Air Raid Precautions in Factories and Business Premises(A.R.P. Handbook No. 6).
Auxiliary Fire Service, Uniforms and Equipment,Specifications.
Memorandum on Emergency Fire Brigade Organization.
Emergency Fire Brigade Appliances.

CANADIAN

Air Raid Precautions--General Information for Civil Authorities.
Air Raid Precautions--General Information.
Organization and Instruction Manual--Ontario Civilian Defense Committee.

Chemical Warfare Service Enlisted Replacement Center.

On February 15, 1941 there was activated at Edgewood Arsenal a Chemical Warfare Service enlisted replacement center, with the First Chemical Warfare Service Training Battalion consisting of a headquarters and headquarters company and four

training companies. This battalion was activated under authority received from the War Department January 13, 1941 and has been organized in accordance with Tables of Organization 3-515 issued November 1, 1940.

The replacement center will train enlisted personnel,chiefly selective service men. The present schedule calls for processing approximately 880 men every three months. Divided into three white units and one colored unit, they will spend forty-four hours a week undergoing training.

This training will be divided into three phases, the first being basic military training. During the second phase the rudiments of chemical warfare and defense against chemical attack will be taught. At the end of five weeks the third phase of training will begin. The white companies will be broken up into smaller groups and given special instruction designed to fit them for assignment to depot companies, service companies and air corps detachments. During this phase the colored company will remain intact and will be given special training in decontamination procedures.

Disinfection of Training Gas Mask.

Instructions contained in a recent War Department directive relative to the disinfection of the training gas mask are herewith reproduced for the information of all readers of the Bulletin.

A three percent solution of formaldehyde will be used to disinfect the training gas mask and all other gas masks with plastic lenses. A three percent solution of formaldehyde is made by adding one part of U S P formaldehyde solution to twelve parts of water. U S P formaldehyde solution is forty percent formaldehyde otherwise known as Formalin. When the disinfecting of gas masks is done in a closed or poorly ventilated room,the personnel involved should wear gas masks,otherwise the process of disinfection should be carried out with the three percent formaldehyde solution exactly as now prescribed in Basic Field Manual FM 21-40, paragraph 34e.

This procedure of disinfecting a gas mask is as follows:

In disinfecting a gas mask, the facepiece should be kept lower than the canister to prevent the disinfectant from running into the hose and canister. Hold the mask in the hand, saturate a small piece of clean rag with the disinfectant, and sponge the entire surface of the facepiece,including the outer and inner side of the deflector. (In this operation the facepiece should not be turned inside out.) Then apply the disinfectant similarly to the outside of the outlet valve.

Pour about a teaspoonful of the disinfectant into the exit passage of the angletube. Press the sides of the outlet valve with the thumb and finger so as to let the disinfectant run out. Do not shake off the excess.

Allow all disinfected parts to remain moist for about 15 minutes and then wipe out the inside of the facepiece with a clean dry rag. The mask should dry thoroughly in the air before it is returned to the carrier.

Training Manuals.

Official War Department training manuals have largely superseded Chemical Warfare School texts and are now principally used for instructional purposes at that school.

To the end that any person charged with training in chemical warfare may familiarize himself with the latest pertinent data, the following list of the more important new training manuals is published.

"Defense Against Chemical Attack", Basic Field Manual No. 21-40. $.20.

"Tactics and Technique",Chemical Warfare Service Field Manual, Volume I. $.25.

"Use of Smokes and Lacrimators in Training", Technical Manual No. 3-305. $.10.

"Meteorology", Technical Manual No. 3-240. $.10.

"Military Chemistry and Chemical Agents", Technical Manual No. 3-215. $.25.

"Examination for Gunners", Chemical Warfare Service Field Manual No. 3-10. $.10.

"Hand Grenades", Basic Field Manual No. 23-30. $.10.

"List of Publications for Training", Basic Field Manual No. 21-6. $.10.

These manuals may be obtained through the Book Department.

Chemical Warfare Service Veterans' Association.

The secretary-treasurer of the Chemical Warfare Service Veterans' Association reports that the fifth annual convention of that organization will be held at Milwaukee in conjunction with the National American Legion Convention this September.

This organization is composed of honorably discharged or still active members of the Chemical Warfare Service.

Scientific Liaison Mission.

J. B. Conant, president of Harvard University and director of the division concerned with chemical problems of the National Defense Research Committee, sailed February 15 for London as head of a three-man mission appointed by President Roosevelt to exchange scientific information vital to the two nations. Dr. Conant, a major in the Chemical Warfare Service during the World War and one of the distinguished scientists of this country, is exceptionally well qualified for this mission.

Accompanying Dr. Conant were Frederick L. Hovde, assistant to the president of the University of Rochester and professor

of chemistry, and Carroll L. Wilson, formerly assistant to President Karl Compton of Massachusetts Institute of Technology and connected for some time with the National Defense Research Committee. Dr. Conant and Mr. Wilson are expected to return shortly, leaving Mr. Hovde abroad as permanent secretary and liaison officer for future missions which the White House announcement said would be sent from time to time to study different phases of British scientific research.

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We are all isolationists if that term implies a passionate desire to continue in our own way of life, to safeguard the fruits of our dearly-won freedom, to advance still further the social regeneration that has marked our progress in recent years. But we cannot preserve these blessings by the mere wishing. We must be ready to defend them in the face of aggression.

- *Hon. Robert T. Patterson*

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RECENT BOOKS AND ARTICLE

Books

WITH CUSTER'S CAVALRY. *By Katherine Gibson Fougera. Caldwell, Idaho: The Caxton Printers, Ltd., 1940. 285 pages. $3.00.*

The author presents many stirring incidents in the history of the famous Seventh Cavalry during the decades immediately following the Civil War.

While many accounts of the battle of the Little Big Horn have been written, none are perhaps more credible than this. The story is based on incidents related by Katherine Gibson, the mother of the author. Katherine Gibson and her husband, Captain Francis Gibson of the Seventh Cavalry, were personal friends of Custer. Captain Gibson was among the first to make observations on the battlefield after the massacre.

Chapters dealing with the Custers, garrison life at Fort Lincoln, buffalo hunting, Christmas on the frontier, and the massacre are especially interesting.

MILITARY CHEMISTRY AND CHEMICAL AGENTS. TECHNICAL MANUAL NO. 3-215. *Washington: War Department, 1940. 164 pages. $.25.*

This manual presents fundamental principles of physics and chemistry with which the officer who may encounter chemicals in the field should be thoroughly familiar. It contains much information not previously published in official texts. It includes structure, states and properties of matter; nomenclature and classification of organic compounds; chemical and physical properties on which depend the suitability of individual chemicals for use as chemical-warfare agents, and their tactical and physiological classification.

FIRE FROM THE AIR, THE A B C OF INCENDIARIES. *By J. Enrique Zanetti. New York: Columbia University Press, 1941. 54 pages. $.50.*

An international authority on military incendiaries has presented here a precise and informative pamphlet on fire warfare. Colonel Zanetti served with distinction as a chemical warfare officer in the AEF and is an active member of the Chemical Warfare Reserve.

Written to fill a need of those concerned with fire protec-

tion, this booklet contains interesting information on the history of fire weapons; why Germany failed to use electron bombs during the first World War; characteristics and behavior of the chief military incendiaries as well as tactical and technical considerations in their use.

FIRE DEFENSE. *Published by N.F.P.A. Boston, 1941. 232 pages. $1.50.*

This is a comprehensive treatise by leading members of the National Fire Protective Association, looking toward the formulation of plans for a coordinated fire defense.

It contains authoritative sections on air-set fires, bombs, sabotage, civilian protection, fire fighting, and the safeguarding of industrial production for defense.

The book includes, in addition to the compiled subject matter,a great number of instructive illustrations and a selected bibliography of publications on the subject of fire defense measures.

FLIGHT TRAINING FOR THE ARMY AND NAVY. *By Captain Burr Leyson. New York: E. P. Dutton and Company, Inc., 1940. 283 pages. $2.50.*

This book is an up-to-date compilation of basic data designed to aid both military and nonmilitary students of aviation.

Each important step in flight training from the elementary principles of physics, to the requirements and training for pilots of the Army, Navy and Civil Aeronautics Administration, is considered.

The author, a graduate of American and English schools of military aeronautics, and active in various phases of aviation since 1917,has long been considered an expert on flight training.

Article

HOW HOMES CAN BE PROTECTED AGAINST AIR ATTACK. *By Lt. Col. A. M. Prentiss. May Popular Science.*

This article is a condensation of chapters of Colonel Prentiss' forthcoming book *Civilian Air Defense.* In it the author describes and illustrates the latest developments for protection of the home against the triple hazards of explosive, gas, and incendiary attack.

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Books reviewed in these pages may be obtained through the Book Department, Chemical Warfare School.

TOPICAL INDEX OF THE CHEMICAL WARFARE BULLETIN

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"When bad men combine, the good must associate; else they will fall one by one, an unpitied sacrifice in a contemptible struggle."

- *Edmund Burke*

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