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PAGE/A (S) AND STRATEGICAL WARFARE POLICY
(STAFF STUDY)

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IN REPLY REFER TO:

SECRETHEADQUARTERS, ARMY AIR FORCES
WASHINGTON

MEMORANDUM FOR THE CHIEF OF AIR STAFF:

SUBJECT: Army Air Forces Chemical Warfare Policy

DISCUSSION

1. This study was initiated at the request of the Assistant Chief of Air Staff-3, Headquarters Army Air Forces, for the following purposes:

- a. To evaluate and enumerate the capabilities, present and future, of chemical, bacteriological and incendiary agents and allied material as weapons for aerial employment.
- b. To formulate an Air Forces policy on chemical warfare.
- c. To outline the actions required to make this policy effective.

2. The facilities of Edgewood Arsenal, Maryland, and Camp Detrick, Maryland, agencies of the Chemical Warfare Service, have been utilized in the preparation of this paper. It has been reviewed and concurred in by the Chief, Chemical Warfare Service.

3. For the purposes of this paper, chemical warfare is defined as the aerial employment of chemical, bacteriological and incendiary agents, fire bombs, smoke, and allied weapons, and defense against like weapons in the hands of an enemy.

4. Chemical warfare is particularly adapted to strategic employment by reason of its high weight-efficiency ratio and pervasiveness or "extended effectiveness". The scope of its capabilities as a tactical weapon is limited only by the accuracy in direction and dosage with which it can be applied. Its application on a mass scale is most efficient through Air Power and this marks chemical warfare as a primary aerial weapon. As a consequence, responsibility for providing the principal impetus for its development as an air weapon rests squarely with the Air Forces. In recognition of this fact, the first purpose of this study is to state the capabilities of air chemical warfare. Other dependent purposes are stated in paragraph 1.

5. Offensive chemical warfare is carried out by three principal means -- chemical, bacteriological and incendiary agents. Each group of agents has demonstrably major capabilities unmatched by any other known weapon when used in their proper application.

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a. Chemical agents. (1) The toxicological effectiveness of a chemical agent is technically measured by the results of the time of exposure of an individual to an effective concentration. Its military effectiveness can be gauged by the ability of the Air Forces to employ it in suitable concentrations against suitable targets. Expressed in terms of aerial employment, one B-29, carrying forty 500-lb phosgene (CG) filled bombs will produce a concentration over an area of 40,000 square yards which will have a lethal effect on all personnel unprotected for as short a time as thirty seconds. If personnel are unprotected for two minutes, one B-29 can achieve the same results over an area twice as great. Newer agents are some twenty-five times as effective as CG and will make it possible to get the same results with a much smaller amount of material or cover a far greater area without increasing the bomb load requirements. Chemical warfare agents have reached super lethal toxicities and consequently enhanced capabilities as weapons of war. The primary task is to provide the means by which they can be effectively utilized by the Air Forces.

(2) An evaluation of chemical warfare entails its comparison on like terms, with weapons of other types. Gas is superior to high explosives when used against personnel. The principal reason gas is superior to the explosive munition is because its action is not confined to the impact area. It will travel and it will penetrate. These unique characteristics constitute superiority not only over the effects of conventional type high explosives but over those of atomic munitions as well. Indications lead to the belief that, at a distance of 2500 yards downwind from the impact area, the half mile front of a gas concentration generated by five B-29 bomb loads of CG will have greater lethal effect on unprotected personnel than that of an atomic bomb the same distance from the center of its impact area. The only reason this is not stated as a fact is the relative lack of data as to casualties caused by the atomic bomb. This "extended effectiveness" will be vastly augmented by the use of the new agents mentioned above, equal quantities of which will permit the coverage of a far greater area with a more lethal concentration, or by which concentrations of equal potency can be achieved by a materially smaller force. One agent, the most toxic known to man, is 2000 times as lethal as mustard gas. As compared to high explosives, gas persists -- another form of "extended effectiveness". Depending upon the agent and weather and terrain conditions, it may retain lethal or harassing capabilities in an area for long periods of time.

(3) Another superior and unique characteristic of gas is that it is capable of being employed to knock out an objective

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without knocking it down. Its tasks can be accomplished without the widespread and oftentimes needless and wanton destruction brought about by high explosive or atomic munitions. The material devastation in certain areas of Germany and Japan has vastly complicated the problems of occupation. Better results in the breaking of the will of our enemies to resist might have been accomplished by the use of chemical warfare thus leaving more of the physical means for the necessary reconstruction of their national economies. Its operational application can be scientifically controlled and required expenditures for desired results accurately determined. If the objective is anti-personnel, it can be achieved without destructive and unwanted by-products. If the objective is materiel, the target can be so contaminated as to render it unusable for a given period of time without physically destroying it. In these respects gas is a superior weapon to the atomic bomb which is entirely destructive, both of personnel and materiel. Devastation follows the atomic bomb. The effect of gas is limited to the reduction of the power of resistance of the enemy and it leaves no devastation in its wake.

(4) The maximum effectiveness of certain chemical agents depends upon an ability to dispense them in the extremely divided form known as an aerosol. The development of very large capacity aerial instrumentalities for carrying war to the enemy will not only permit the utilization of great toxic aerosol bombs but probably will result in vehicles of supersonic speed being developed as aerosol producing and dispersing agencies in themselves. The evolution of facilities of this nature, combining the most effective agents and means of dispersion, will vastly extend the decisive capabilities of chemical warfare as an aerial weapon. Chemical warfare is capable of expansion and development matching the most advanced concepts of airpower in the future.

- b. Bacteriological chemical warfare agents. (1) Intensive study of the military capabilities of bacteriological agents was initiated by ourselves and our allies during World War II because it became evident that our enemies were engaged in like investigations. The project was assigned a priority second only to that of the implementation of atomic weapons. Efforts along these lines have resulted in the development of agents which can be effectively employed against human, animal and vegetable life. Satisfactory anti-toxins against human and animal diseases, militarily employable, have been developed, thus permitting the employment of these agents with the assurance of reasonable protection to our own personnel and livestock.

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(2) Bacteriological chemical warfare agents can be employed with a minimum expenditure of materiel and equipment. They are difficult to detect and identify and defense requires the use of all resources. Many are highly transmissible. Some are highly persistent in their resistance to eradication. Those effective against humans can be used to produce results ranging from lingering sickness or incapacity to a high rate of mortality, with the side results of saturating the facilities for medical treatment and consequent fear and panic. Those effective against domestic animals are deadly and highly contagious, requiring the most drastic control measures. In this connection, it would have been possible for the Japs to introduce an agent into this country via their paper balloons with a good chance that it would have decimated our live stock population before it could have been brought under control. Plant life can be effectively attacked. Vegetation can be defoliated for military purposes. Basic food crops can be materially reduced in productivity or totally destroyed. Ten tons of a certain chemical herbicide applied to irrigation waters will destroy 2500 acres of rice crops.

(3) Bacteriological chemical warfare agents like other chemical warfare agents, constitute a powerful strategic weapon very definitely adapted to aerial use. The tremendous effectiveness of bacteriological agents is due to their extremely high weight-efficiency ratio and to their spreading effect. This high degree of efficiency will permit a minimum number of aircraft or guided missiles employing bacteriological agents to achieve greater results than by means of other weapons, even including the atomic bomb. Present indications are that a missile having the same capacity as the German V-1 can carry a sufficient load of certain bacteriological agents to achieve anti-personnel results comparable to that of an atomic bomb. Bacteriological agents are especially adapted to employment by guided missiles and similar instrumentalities because they need not be laid down with pin-point accuracy to be effective and because their high weight-efficiency ratio makes them effective in extremely small amounts. The means of achieving wide dispersion of the minute quantities necessary for devastating results is a problem yet to be solved. Each principal agent may require a distinct means of application or type of munition. A munition now under development is a half pound bomb, 970 of which can be contained in a 500 pound aimable cluster. A B-29 can carry a total of 38,800 such individual bombs. Loaded with certain bacteriological agents and used under favorable circumstances, each of these half pound bombs would have lethal capabilities far greater than a 500 pound high explosive bomb. A B-29 load of the latter munition, dropped in a field would leave craters having a nuisance value to the farmer but not particularly deadly otherwise. A B-29 load of bacteriological "shell bombs" dropped in the same area would have the capability of creating a devastating epidemic among humans or livestock or both.

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(4) The decision has been made to continue intensive research and development work on bacteriological warfare. The research center now set up under the Chemical Warfare Service is preparing for a long term program of activity. Support of this work and close coordination of its potentialities with the essentially offensive doctrine of the Air Forces is absolutely imperative. Neglect of so potent a means of warfare by the agency best fitted to employ it would constitute an unconscionable threat to our national security.

c. Incendiary agents and fire bombs. (1) The effectiveness of incendiaries and fire bombs is best illustrated by the results obtained by their use in World War II. The most extensive damage ever produced by a single aerial bombardment mission was achieved with a 100% load of incendiary bombs. Experience in actual employment in all theaters has shown conclusively that incendiary bombs are at least five times as effective as high explosives in the reduction of objectives sufficiently inflammable to support a continuing fire. In the present world nearly all strategic targets are susceptible to extensive damage or destruction by incendiary munitions. Targets susceptible of major damage or destruction by incendiary attack are not confined to the flimsy type of residential construction common in Japan. The modern Mitsubishi air frame and assembly plant in Nagoya, Japan, larger than Willow Run, and containing more than one-fifth of Japan's combat aircraft assembly facilities was rendered completely inoperative by incendiary attack.

(2) Incendiary munitions will cause more intensive damage than high explosives to targets which are vulnerable to the action of intense heat. Such damage can be produced either by the heat engendered by the combustion of inflammable materials in the target area or by the high temperatures of the incendiary bombs themselves. There is reason to believe that future developments will produce incendiary bomb fuels which will cause intensive damage even in the absence of readily inflammable target material. In addition, incendiary munitions have already been developed and produced by the Chemical Warfare Service which include a highly toxic element without sacrificing the incendiary effect. The M50-T four pound incendiary toxic bomb produces initial concentrations, under favorable circumstances, twice as lethal as phosgene.

(3) Conventional incendiary munitions are applicable to tactical operations. The flamethrower early demonstrated the value of flame and fire as a tactical and anti-personnel weapon. Fire bombs were the answer to the need for an aerial flamethrower. Hastily improvised, their employment in critical situations under actual battle conditions proved fire bombs to be far more effective than high explosives in dislodging or destroying personnel in fox holes, pill boxes or other semi-fortified positions.

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Carried by fighters in low level or glide attacks they were also highly efficient against troop and materiel concentrations whether in the open or under forest cover. During the last crowded days of the European war fire bombs and conventional incendiaries proved to be outstandingly effective against railroad rolling stock, truck columns, supply dumps and local strong points or centers of resistance. These and similar uses can be greatly developed and techniques improved upon. The tremendous potentialities of this type of weapon can be realized by the development of munitions aerodynamically designed for use by high speed attack aircraft or guided missiles. Improved plasticized fuel fillings are under development which will vastly increase the capabilities of this weapon. The application of the fire bomb principle to rocket use is practical.

(4) Unlike other chemical warfare weapons, there was no prohibition during World War II against the unrestricted use of incendiaries and fire bombs. In spite of this, the lack of understanding of their effectiveness and an unwillingness on the part of commanders to exploit their possibilities retarded their effective application until the last stages of the war. The present state of development of incendiaries and fire bombs is only a fraction of their future potentialities. Fire is a devastating and decisive weapon of aerial warfare.

- d. Radioactive agents. (1) One of the possibilities of the processes of atomic fission is the imparting of radioactivity to normally inert materials, including solids, liquids and gases. With suitable aerial dispensing techniques the anti-personnel capabilities of such substances are incalculable. Physiological effects similar to those achieved by chemical agents are possible to a greatly augmented degree. The possibilities in this field warrant intensive investigation not only from the viewpoint of developing a new and powerful air chemical warfare weapon but also by reason of the necessity for evolving defensive measures. The Chemical Warfare Service is presently engaged in producing masks and other protective devices for personnel exposed to radioactivity in various phases of the atomic bomb test project.
- (2) Aerial munitions capable of dispersing a radioactive aerosol in large volumes over wide areas are conceivable. Research into the capabilities of radioactive materials employed other than as high explosives must be carried out with the active and informed support of the Air Forces.
- e. Smoke. While not a weapon of offense in itself, smoke has major applications in support of other weapons and arms both from the offensive and defensive viewpoints. Its employment is of particular interest to the Air Forces. Visual precision bombing of

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specific targets can be hampered or prevented by smoke munitions and equipment presently available. While the difficulties appear great at present, a smoke which will shut the eyes of radar is a possible Chemical Warfare Service development. Smoke aerially employed can prevent hostile detection of and effective resistance to offensive operations. Airborne troops can be concealed throughout their descent from the plane from which they are dropped to the point of assembly on the ground. Beach landings, river crossings, large scale land envelopments and smaller local operations can be successfully screened by the use of aerial smoke. Anti-aircraft installations can be blinded by enveloping them in smoke. Smoke is the most effective means of visual communication in the assembly of bomber formations, air-sea rescue operations and for the marking of bomb release lines and zones of bombardment on the ground. Newly developed, non-flaming type intensely colored smokes will vastly increase the efficiency of such applications of this munition in the future.

6. Defensive capabilities. The scope and decisive character of chemical warfare is such that it will inevitably be exhaustively explored and exploited by all major military powers. The development of defensive equipment, materiel, and technique must keep pace, not only with our own progress in offensive capabilities but with that of all possible enemies as well. As the major factor in the outcome of future warfare, air power must be prepared to withstand the first and heaviest blows of an aggressor. Air Forces installations and facilities will be priority targets for enemy attack from the air. They are, by their very nature, particularly vulnerable to chemical attack. Because chemical warfare is most effectively employed by aerial means, the Air Forces are necessarily largely concerned with the evolution of adequate and progressive means of defense against this form of aerial attack. The closest coordination with agencies charged with the development of defensive equipment is necessary in order that the special needs of the Air Forces are kept under constant review and consideration.

7. To repeat, chemical warfare has unique and decisive capabilities as a weapon of war. It encompasses all of the known means of reducing the will of an enemy to resist -- fire, fear and famine, disease, destruction, and death, and is the only weapon which does. Unlike other weapons, it possesses the quality of "extended effectiveness", in time and space. It is a distinct means of warfare, not merely a piece of aerial armament. A failure to fully appreciate it as a potentially decisive factor in future warfare might be militarily disastrous.

8. Chemical warfare is now and surely will be explored and exploited by all powers regardless of moral or political inhibitions. A watch-and-wait policy toward its development is unrealistic and a threat to our national security. Complete physical preparedness and a public conditioning to its initiation and continued employment is imperative. It is not necessarily a retaliatory weapon but a distinct and positive offensive means and technique

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of warfare capable of being a decisive factor in military operations. It exerts a distinct influence on all tactics and techniques of warfare.

9. The United States, by reason of its resources in material and technical capabilities, industrial capacity and dominant air power is better fitted for the development and decisive employment of chemical warfare than any other nation.

10. To repeat once more: The application of chemical agents on a mass scale is most efficient through air power and this marks chemical warfare as a primary air force weapon. The continued and relentless development of aircraft, guided missiles and similar carriers, to which the Air Forces is committed, is militarily short-sighted unless accompanied by the parallel and equal evolution of the most effective munitions and agents for these instrumentalities to employ against an enemy.

11. A positive and comprehensive Air Forces chemical warfare policy is imperative. Procedural policies presently governing chemical warfare activities in the Air Forces have, in the past, not recognized its capabilities as a weapon. The offensive doctrine has been prosecuted solely with regard to incendiary agents and that only as the result of the efforts of a few well-informed and far-sighted staff officers and field commanders in the face of opposition and in spite of the lack of a recognized major policy. The effective utilization of chemical warfare can only be achieved if it is firmly incorporated in the essentially offensive doctrine of the Air Forces.

12. A decision to enunciate a policy must be based upon a cold appraisal and acceptance of the value and desirabilities of the objectives to be achieved thereby. The promulgation of a policy is insufficient in itself. There must be also the determination and machinery to carry it out to its fullest effectiveness. An Air Forces policy which recognizes chemical warfare as a decisive aerial weapon must also recognize that it entails functions and responsibilities which must be carried out. It is important that the functions and responsibilities required to bring it to and keep it at the required level of effectiveness, not be eliminated or subordinated to agencies or activities not connected with it or with the achievement of the desired objectives.

ACTION RECOMMENDED

1. An acceptance of the statements contained in the preceding paragraphs will indicate the need for the establishment of an Army Air Force Chemical Warfare Service policy under which action can be taken by all echelons of the Air Forces in accordance with the importance of the weapon. The following is suggested as such a policy.

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"The Air Force recognizes chemical warfare as a distinct means and technique of waging offensive war which has outstanding capabilities and potentialities. It is predominately and particularly adapted to aerial employment. It provides a highly efficient, economical, and versatile weapon, the use of which will profoundly influence the tactics and technique of all other methods of warfare. It is capable of becoming a major and decisive factor in military operations and must be exploited to the fullest extent as an aerial weapon as an essential concomitant to the achievement of a dominant air power.

Air chemical warfare planning, research, development, production, indoctrination, training and the evaluations of effective tactics and techniques for its employment will be carried forward to a degree commensurate with its decisive importance.

All applicable facilities and energies of the Air Forces must be devoted to the achievement and maintenance of a complete state of readiness to employ chemical warfare, not as a retaliatory measure, but initially and relentlessly."

2. The following specific action should be taken to effectuate the above suggested policy:

a. The policy should be approved and published to all staff and field echelons of the Air Forces. Such unequivocal instructions covering administrative, organizational, technical, training, supply and intelligence phases of the policy as will insure its complete and effective implementation should accompany the statement of the policy.

b. The necessity for the most advanced research and development of weapons for chemical warfare air use should be recognized and specialist technical chemical warfare personnel should be assigned to key positions wherever needed to influence this development. These positions are obviously needed in the Air Force Board, the Air Force Proving Ground Command, Air Force laboratories, Edgewood Arsenal and Dugway Proving Ground. Other positions will be developed by progress. The officers assigned to these positions should be provided with suitable organizations comprising necessary assistants, both commissioned and enlisted, to enable them to carry out their work. The Technical Branch of the Air Chemical Office should be enlarged. This will involve the assignment of one more officer and one civilian of a professional grade at least.

c. All steps necessary to effectuate the storage and distribution of chemical warfare materials by the Air Forces should be taken. This will involve the allocation of the necessary storage space in present Army Air Force depots and/or the building of depots to take care of the quantities required, and the authorization of the personnel required for operation.

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d. Specific decision should be made that chemical warfare supply will not be lumped with any other business, since it represents the materiel of a separate mode of warfare and requires storage, surveillance, and handling by specialized personnel and, in many cases, in specialized storage places.

e. Training of personnel in all echelons of the Air Forces in the capabilities and in the application of air chemical warfare must be accomplished by adequate presentation of the subject in all phases of the Air Forces training program. The higher staff levels, and field commanders particularly, must be thoroughly indoctrinated. The accepted policy will be hamstrung if the present misunderstanding, ignorance, distrust and fear of chemical warfare is not dispelled by constant and capable exposition of its potentialities. Effective employment of air chemical warfare will be possible only if field training is carried out in the fullest and most practical degree. Such chemical training must be conducted at all levels by chemical officers. A chemical "Service" school within the Army Air Forces, comparable to present Service Schools, directed and operated by chemical officers is essential. A Chemical Warfare Center (Arsenal) on a separate base, commanded by an Air Force officer of adequate rank, with a Chemical Warfare Service officer as Deputy, should be established to provide for an Air Chemical Service School, such research and development as may be required, testing of chemical materiel, tactics, and units, and a station for the activation and equipping of such units. Such a Center must be adequately supplied with test airplanes, flying personnel, meteorological station and such other flying aids as are needed.

f. The Army Air Forces Troop Basis must contain sufficient numbers of suitable Chemical Warfare organizations to permit the Air Chemical Warfare to do its job in peacetime and to provide the necessary cadres for expansion during war.

g. Tactics and technique for the effective employment of chemical warfare agents must be developed. Efficient adaptation of chemical munitions to aerial instrumentalities of attack and a comprehensive program of full scale field tests and operational exercises must be maintained. The experience of World War II in the employment of incendiary and fire bombs and smoke must be studied and capitalized upon. The most effective means of utilizing the newer agents and techniques must be explored and standardized.

h. A Chemical Intelligence Section should be organized to operate directly under the Assistant Chief of Air Staff -2. This Section should be composed of Chemical Warfare Service officers and should be charged with all Chemical Warfare Service intelligence applicable to Air Forces. In addition, at least one Chemical Warfare Service Officer from the Air Forces should be assigned to G-2 as part of the combined War Department set-up.

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1. Chemical warfare should be given consideration whenever any job of planning is being done by the Air Staff. Either personnel from the Office of the Air Chemical Officer should be invited to participate in such planning, to the extent necessary to make sure that chemical warfare is adequately considered, or qualified Chemical Warfare Service commissioned personnel, whose principal duty would be planning for chemical warfare, should be assigned to the Office of the Assistant Chief of Air Staff -5.

3. Having decided that chemical warfare is a distinct and decisive means of warfare having a definite bearing on basic doctrine and the success of air power, and having reached an understanding of what action is necessary to effectuate the accepted policy, it is necessary to determine the best means of assuring that this action is properly monitored, coordinated and supervised within the structure of the air forces. Experience in all fields of technical endeavor have shown that only by the assignment of experienced personnel with suitable rank, charged specifically with the responsibility for carrying out the specialized functions concerned, can the essential monitoring, coordination and supervision be accomplished. This personnel must be so organized as to be able to do these things efficiently. Some form of articulated service is indicated. The nomenclature of the agency or instrumentality required is not important. The manner in which it is constituted and operates is critical. The terms "integration", "corps", "service", and similar terms are confusing because they mean different things to different people and are involved with considerations which have exactly nothing to do with the picture, as a whole. It is not desired to quibble over words or titles. The following specific recommendations are made:

Chemical warfare should be represented in Air Force Headquarters by an Air Chemical Officer of sufficient rank and experience to represent the Commanding General in a manner commensurate with its importance as a major means of aerial warfare. General officer rank for the Air Chemical Officer is essential. An officer of lower rank cannot function effectively in the higher staff and operational levels and exercise proper staff and technical influence in keeping with the importance of his functions. Staff representation throughout all lower echelons should be established at the same level of relative rank so as to permit a direct chain of responsibility from the top to the lowest echelons of command. This vertical technical staff structure should be recognized as a specialized functional activity. The responsibility for the supervision of all chemical warfare activities of the Air Forces under the Air Staff should be charged to the Air Chemical Officer.

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