THE ROLE OF CHEMICAL DEFENSE IN CHEMICAL WARFARE, CHEMICAL DETERRENCE, AND CHEMICAL DISARMAMENT*

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Introduction. Chemical defense serves several essential roles--in chemical warfare, in chemical deterrence, and in chemical disarmament. A factor of central importance in each of these roles is the high degree of protection against chemical weapons that can be achieved by practical measures of chemical defense. This sets chemical weapons apart from conventional weapons -- against which no comparable degree of protection of combatants can generally be achieved. The unique effectiveness of chemical defense has important implications for warfare, deterrence and disarmament.

In chemical warfare, a good chemical defense greatly limits the damage inflicted by chemical attack. Historically, this was seen in the dramatic effect that anti-chemical protection -- chiefly the gas mask -- had in limiting the importance of chemical weapons in World War I. Developments since then -- greatly improved masks, protective clothing, detectors and other equipment and doctrine -- have further increased the margin of protection and the ascendancy of the defense.

In addition, chemical defense acts as a deterrent to the initiation of chemical warfare. The better a force is protected against chemicals, the less incentive there will be for a

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chemically-armed adversary to initiate chemical warfare. Examination of official documents clearly shows that such defensive deterrence operated in the European theatre in World War II, where both sides knew the other was well equipped for chemical defense and neither side used chemicals. Indeed, chemical warfare has never been initiated against forces with adequate anti-chemical protection.

Chemical defense can also help prevent the proliferation of chemical weapons. If good anti-chemical protection is generally available, the acquisition of chemical weapons becomes less cost-effective, whether for first use or for retaliation in kind. Evidence for the operation, albeit imperfect, of such defensive stability is seen in the fact that nearly all modern military establishments deploy gas masks and other anti-chemical protective equipment, while far fewer have actually stockpiled chemical weapons.

Finally, chemical defense has an essential role in chemical disarmament. There are at least three reasons why this is so. First, the prevalence of good chemical defense favors compliance with a chemical disarmament treaty by making chemical weapons less militarily useful, thereby reducing the incentive for having them. Second, the prevalence of chemical defense facilitates verification. The more effective the defenses he faces, the more large-scale and therefore more easily detectable are the preparations the would-be violator is forced to make in order to achieve military significance. Third, should violations nevertheless occur, chemical defense renders them much less dangerous.

Since a chemical disarmament treaty, to be effective, must be multilateral, it follows that access to measures of anti-chemical protection should be widely diffused among its members.

This argues for a considerable degree of openness and accessibility in matters of chemical defense.

The conclusion is clear. Anti-chemical protection is essential today, when the possession of chemical weapons is not prohibited by international law and when several nations possess stocks of chemical weapons. Moreover, chemical defense will remain essential after the probable entry into force of the Chemical Weapons Convention -- the chemical disarmament treaty now nearing completion at the multilateral Conference on Disarmament in Geneva.

Chemical defense in World War I. The first German cloud attacks with chlorine gas in Belgium in April 1915 caused some British and French scientists to become deeply pessimistic, arguing that the preponderance of Germany in industrial chemistry would give that nation a major advantage. Others argued that the gas threat would be largely offset by anti-chemical protection, based on knowledge of human physiology and other sciences in which the Allies were proficient. The latter view proved correct.

Chemical weapons caused about 3% of an estimated 15 million casualties on the Western Front. Although much effort was expended in the provision and use of chemical munitions and although gas caused much misery to troops on both sides, it was not a very important weapon in World War I, owing largely to the effectiveness of the defenses that even then could be provided against it, chiefly the gas mask.

Nearly all of the innovations that first saw widespread use in World War I subsequently became standard in military establishments around the world: machine guns, barbed wire, tanks, motorized transport vehicles, radios, aircraft, submarines -- but not gas. Without doubt, the effectiveness and availability

of anti-chemical protection has been a major factor in limiting the spread of chemical weapons.

Some authors writing between the world wars, using inaccurate data, argued that chemical weapons were much more effective than conventional weapons in producing casualties in World War I. But records of German ammunition production and of British casualties in Europe in 1918, the year in which chemical warfare reached its highest stage of development, show that chemicals produced no more casualties, shell for shell, than did high explosive munitions. About one-fifth of German artillery shell production was chemical and about the same proportion of admissions to British medical units attributable to artillery were chemical. This does not include battle fatalities that never reached aid stations or hospitals, nearly all of which resulted from bullet and shrapnel wounds, not from chemicals. American records show a higher rate of hospitalized chemical casualties, but must be interpreted with care in view of a 1926 Army Medical Department report that attributed a high proportion of the recorded U.S. chemical casualties to malingering.

Even against mustard -- the "king of battle gasses" -- the gas mask kept casualties far below what they would otherwise have been. Mustard was the principal agent used in the war with significant effects not only on the eyes and lungs, against which masks could afford protection, but also on the skin. Although few men had protective clothing, most of the mustard casualties were to the eyes and lungs. Most of these, however, resulted not from penetration of the mask but rather from failure to wear it. Without adequate training and detectors and with masks far less comfortable than those of today, troops frequently failed to mask or they unmasked too soon. Inadequate training and the lack of detectors also caused men to remain in contaminated trenches and dugouts for prolonged periods without realizing the hazard, when

relocation could have prevented skin burns. Relatively few were injured by passing through contaminated areas, and fewer still from direct exposure to liquid mustard from exploding munitions. Because of difficulties in Allied production efforts, Germany had a monopoly on mustard from its introduction in July 1917 until nearly a year later, in June 1918, when French supplies first became available. Nevertheless, even the limited defensive capabilities then available kept the massive and one-sided use of mustard by Germany from having any important effect on the course of the war.

The official British history of World War I states that "gas achieved but local success, nothing decisive; it made war uncomfortable, to no purpose." In his history The Real War 1914-1918, British military historian Basil Liddell Hart wrote that gas had a chance to accomplish something when it was first used but not later, because of the introduction of chemical defenses. The detailed study done for the U.S. Army by Dorothy Kneeland Clark at the Johns Hopkins Operations Research Office, published in 1959, reached the same conclusion.

Chemical defense in World War II. Poison gas was used on a limited scale by Japan against China but it was not used in Europe, even though both sides produced large stockpiles of mustard and other agents, including, in Germany the nerve agent Tabun. It is commonly said that chemicals were not used because of the threat of retaliation in kind. While this may have been a factor, available documents also show that military staffs on both sides were skeptical about the utility of chemical weapons and did not recommend their use. For example, in 1944 Winston Churchill instructed his Joint Planning Staff to examine whether chemical weapons might be useful against the launching of the German missiles then bombarding England. The report sent back to him concluded: "Gas attacks are unlikely to be any more effective

than bombing with high explosives." German military opinion was similar. At the end of the war the commander of the German chemical troops, Generalleutnant Hermann Ochsner, told British interrogators: "Gas was not considered a useful weapon compared to other munitions." Of course, each side knew that the other's military forces had good anti-chemical protection.

By the start of World War II, tens of millions of gas masks had been distributed to civilians throughout Britain. As a result, both British and German chemical warfare experts concluded that poison gas attacks on British cities would cause fewer casualties than an equal weight of conventional weapons. Regarding the possible effects of gas delivered by German V-1 and V-2 missiles, German chemical commander Ochsner wrote in a 1949 report for the U.S. Army: "There was no room for hope that if the V weapons had been given a gas charge, the effect would have been any greater than that of an explosive charge. Under existing circumstances [with the British population protected], gas casualties undoubtedly would have been less than those caused by explosive bombs." Similarly, the British biologist J.B.S. Haldane, advised U.S. military representatives in 1940 that the Germans were unlikely to replace high explosives with gas in the London bombing because "people would soon learn to protect themselves, since they have been educated to it, and all have gas masks."

Without chemical defense, there is no doubt that gas would have been considered a highly effective weapon in World War II. As it was, chemical defense on both sides precluded any concerted military advocacy for initiating chemical warfare. While other factors, including political ones, also enforced restraint, the prior restraint of military skepticism kept recom ndations for initiation from being made to national command aut orities.

Lesser wars. Poison gas has been used in only a few of the more than 200 wars fought since World War I, and in every case it was initiated against forces entirely lacking or highly deficient in protective equipment. This was so, for example, in Ethiopia (1935-36), China (1938-42), Yemen (1966-67), and in the recent Iran-Iraq War.

Iraqi gas attacks caused only a small proportion of total Iranian battle casualties. Nevertheless, the use of gas against poorly prepared Iranian military units and against completely unprotected civilians in Iranian towns, combined with intense apprehension that Iraq would use gas against Teheran in the War of the Cities were certainly among the factors contributing to the collapse of Iranian morale in 1988. It is unclear whether Iranian units engaged in major action under chemical attack ever achieved even a moderately high level of anti-chemical protectedness and training. So far as I am aware, however, the Iran-Iraq War provides no example of gas attacks with major tactical impact on well prepared troops.

In short, history provides no example of the initiation of chemical warfare against well-protected forces, nor any evidence that chemicals can be more than marginally effective against forces with good protective equipment and training.

Military rationale for chemical weapons. If anti-chemical protection is so effective, and if both the United States and the Soviet Union have good chemical defenses, why have they both produced and maintained large chemical stockpiles -- tens of thousands of tons on each side -- until the recent bilateral agreement to cease production and cut back stocks?

Influential studies done for the U.S. Army in the 1950s and 60s showed that chemicals were generally not competitive with high explosive weapons for direct casualty production against

protected forces. Instead of casualty production, the effect of anti-chemical protective posture in slowing enemy tempo then became and still remains the principal U.S. rationale for maintaining an arsenal of chemical weapons for possible retaliation in kind.

The additional burden that wearing anti-chemical protective equipment and taking other anti-chemical measures imposes on military units has long been recognized, even in World War I. In a modern war of maneuver, anti-chemical protective posture will slow the tempo of combat and logistical operations. The tactical effect of chemicals on a target force then depends mainly on their effect in slowing its tempo and disrupting its time-table and on the effect on troop morale. While the morale factor is hard to study, British and U.S. experience in World War I and in modern exercises, including training with live agent, indicates that well-trained well-protected troops with otherwise good morale will continue to function well in a chemical environment.

Anti-chemical gear can slow troops down for two kinds of reasons. First, masks, gloves, and other equipment can interfere with vision, speech intelligibility, personal recognition and dexterity. But with practice in anti-chemical gear, these problems generally have minimal effects on the achievement of simulated combat missions and further improvements are on the way or can be envisaged. The other effect, which can be more serious, is that protective clothing and the mask can limit body cooling. In cool and temperate weather this is of little consequence, but in hot weather soldiers must avoid prolonged strenuous activity in full protective gear or risk heat exhaustion. When the temperature is high and attack with agents that threaten the skin appears likely, commanders must limit the duration of the most strenuous operations, such as dismounted

assault, order partial opening of the protective ensemble, or confine such operations to the cooler hours of the day and to night time.

Although anti-chemical protection clearly hampers military operations to some degree, the effects on military outcome are difficult to quantify or even define. There are three ways to approach the problem: history, model building and field exercises. We have already summarized some of the evidence from World War I. Model building starts with various measured parameters and makes assumptions about their interactions and effects. Models can be useful for certain specialized purposes but are of dubious value for predicting overall effects on unit mission performance. For example, the summary of a large study done for the U.S. Defense Department in 1975 stated: "The conclusion of this analysis is that the model predicts degradation in unit mission effectiveness that is quite severe and is not supported by any troop tests or field experiments currently available."

Large-scale field exercises, if carefully done and evaluated, can provide more reliable information. Such exercises have shown, not surprisingly, that wearing protective gear seriously degrades the performance of units engaged in prolonged, strenuous effort in hot weather. The same is true of units poorly trained and poorly motivated to operate with chemical defenses. In contrast, trained combined-arms units exercising in temperate weather up to about 80°F (27°C) have been little hampered by the gear, even in sustained operations. In the hot desert in the sun, well trained troops in protective gear have successfully conducted assault exercises for up to two hours. Under common European weather conditions, military units have routinely exercised at or near full anti-chemical protection for several days continuously.

Of course, the net utility of using chemicals depends not only on their effects on the target force but also on the costs imposed on the user. There is a trade-off between the effect of chemicals in slowing enemy tempo and disrupting his timing versus the increased logistic burden, the diversion and attrition of firepower and other assets, and the operational complications and uncertainties incurred by the user. Oschner, in his 1949 report, cited such costs as the reason for not even considering the use of chemicals either in the German drive through France and Belgium in 1940 or the attack of Russia later. It is noteworthy, however, that there are many contemporary studies of the burden of chemical defense on the target force but few studies of the opportunity costs and other costs to the user.

Chemical defense and chemical disarmament. The Chemical Weapons Convention (CWC) being negotiated by the Ad Hoc Committee on Chemical Weapons at the Conference on Disarmament in Geneva, while prohibiting the development, production, possession and transfer of chemical weapons, places no constraint on measures of anti-chemical protection. On the contrary, Article X of the draft CWC is entitled "Assistance and Protection Against Chemical Weapons". Although it is clear that protection against chemical weapons is regarded favorably by all States involved in the negotiation, consensus has not yet been reached on the provisions to be incorporated in Article X. Some countries, particularly among the developing nations, have argued that provision should be made for assistance not only to States Parties attacked with chemicals but also to States Parties facing the threat of such attack. Other countries have argued that arrangements for such assistance should be made largely or entirely outside the Convention, on a voluntary basis. Early this year, specific language seeking to accommodate a range of views was submitted to the Ad Hoc Committee in the form of a Chairman's Paper. For the provision of protective equipment, medical assistance and advice,

it proposes that each State Party undertake to provide assistance according to one or more of three specific modes, to be selected by each State Party according to its individual preferences:

(i) to contribute to a voluntary fund for assistance; and/or

(ii) to conclude agreements with the treaty Organization concerning the procurement, upon demand, of assistance; and/or

(iii) to declare the kind of assistance it might provide in response to an appeal by the Organization.

Under this plan, each State Party would have the right to request assistance if it has been attacked with chemicals or if it faces actions by any State that are prohibited by the Convention. The response to such a request would then be decided within 48 hours by majority vote of the Executive Council of the Treaty Organization.

If agreement can be reached on some form of assistance in chemical defense within the framework of the CWC itself, that would of course constitute added incentive for certain nations to join. Moreover, making the provision of chemical protective assistance a commitment under the treaty would contribute to sustaining interest and effort in anti-chemical protection and in ensuring its general diffusion and availability among States Parties.

In any case, whether through national and purely voluntary efforts alone or through these supplemented by treaty obligation, it is clear that there is an important role for anti-chemical protection in any effective chemical disarmament agreement.

In summary, modern anti-chemical protection can have unique effectiveness against chemical weapons. It can greatly reduce the damage of chemical attack in war; it deters the use and even the proliferation of chemical weapons; and without it chemical disarmament would not be possible.

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