5 December 1978

MEMORANDUM FOR: Deputy Director for National Foreign Assessment

FROM: Director of Central Intelligence

SUBJECT: Chemical Warfare Capability

From time to time, we've published some materials on the Soviets' chemical warfare capability. It also keeps bubbling up in policy arenas with respect to whether we should be putting more emphasis on it or not. Attached is an article from International Security by two of the leading proponents of stronger U.S. chemical warfare capability. I'd appreciate your having someone look at it and let me know whether we agree with its factual assessment of the Soviets' capability in this area.

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Attachment
as stated

The Neglected Threat of Chemical Warfare

Amoretta M. Hoeber and Joseph D. Douglass, Jr.

Beginning in the late sixties, and triggered at least in part by the Dugway sheep incident of 1968,[1] the chemical warfare (CW) capability of the United States underwent a rapid and almost complete decline. By the mid-seventies, the Army Chemical Corps was almost disbanded, and the ability of U.S. forces to conduct operations in a chemical environment has now decreased to the point where the Chairman of the Joint Chiefs of Staff says the U.S. is "not prepared" (Ref. 3, p. 90). Coincident with this unmistakable decline in U.S. interest and capability, the Soviets moved in the opposite direction, not only improving their capability, as they have done in all fields of military activity, but significantly upgrading the relative importance as well. These trends have reached a point where now, among all of the comparisons of U.S./Soviet military capabilities, one of the most lopsided is that for chemical warfare and operations in resulting toxic environments. There, the Soviet superiority over the United States is assessed not by mere factors of two or three, but more often than not, by two or three orders of magnitude. This differential is believed to apply almost uniformly to munitions stockpiles, testing facilities, training activities, equipment, personnel and force structure. While the U.S. attitude about this facet

1. The "Dugway sheep incident" was an accident in 1968 when the nozzle of an aerial spray tank carrying the toxic chemical VX malfunctioned during an open-air test at the Dugway Proving Ground, an Army chemical warfare test site. Within the next several days, 6,000–6,400 sheep grazing some 27 miles away were found dead. While the cause and effect has never been proven conclusively, minute quantities of VX were said to have been found in the sheep tissues, and the connection of the sheep deaths to the chemical test is usually presumed. (Ref. 1, p. 6 and Ref. 2, p. 26)

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of preparedness is characterized by widespread apathy and repugnance,[2] the Soviet approach , as in other military endeavors, is one of serious warfighting capability and readiness.

Whether the mounting Soviet interest and capability derive from the development of more tolerable protective clothing and equipment, from the development of an antidote that enables them to better exploit the use of their own chemical weapons, or merely reflects their seizing upon the opportunity to capitalize on the U.S. decline is not known. What is clear, however, is that the Soviets have an impressive capability and appear well trained and ready; that the United States and the rest of NATO are neither equipped nor trained to any extent comparably to the Soviet Union for this type of warfare;[3] and that the main and significant advantage of chemical warfare emerges in exactly such a condition of asymmetry.

While this state of affairs is now recognized at some of the highest levels in the armed services, and while some actions have been initiated to improve U.S. preparedness (Ref. 4), the program still suffers. The efforts which have been initiated to ameliorate the situation in which we now find ourselves are still definitely of subcritical mass and will probably remain so unless nurtured and guided by unequivocal and widespread high-level support. The trends of improvement are marred by a severe sense of paranoia, continued lack of attention, coordination, and direction, and a fairly common belief that the only politically practicable "solution" is an arms control or disarmament agreement aimed at erasing the problem. The dangers inherent in such an approach and the potential for error in the underlying assumptions are, the present authors believe, of such a magnitude as to warrant a critical review of the subject.

Hence, this article will summarize the state of Soviet chemical warfare capabilities, both offensive and defensive; rationales from the Soviet point of view on the utility of chemical employment in both nuclear and non-nuclear conflict; the state of the U.S. posture to cope with such a threat; and the basic problems associated with resolving chemical warfare issues within the U.S. defense establishment. As the article will show, this assessment leads the authors to the conclusion that there is a significant vulnerability in a critical aspect of U.S. and NATO military capability and that the actions currently under way to reduce the vulnerability in no

2. It is a mark of the U.S. attitude that the author of "Close Encounters of the Third Kind" selected a nerve-gas "accident" as the circumstance that would most assure complete evacuation of an area!

3. In the Chairman's Posture Statement (Ref. 3) the adjectives used to describe these aspects of the U.S./NATO capability range from "not prepared," to "marginal" and "extremely limited," while those used to describe Soviet capabilities are "extensive," "superior," "formidable," and the like (pp. 15, 90, 91).

way match the seriousness of the threat. U.S./NATO forces should expect to have a toxic environment forced on them, and if, as today, they are "not prepared" (Ref. 3, p. 90) to operate in such an environment and to impose comparable problems on the Warsaw Pact forces in response, Soviet use would clearly have disastrous—and potentially decisive—consequences for NATO. And the U.S./NATO lack of capability may well invite exactly that which might be avoided, that is, Soviet use of their chemical warfare superiority.

Chemical Warfare

Chemical weapons are unique among modern weapons in that they impact only on living things—that is, they attack people without destroying physical facilities or equipment.[4] There are several types of chemical warfare agents, with widely differing properties. Some are colorless, some odorless; others can be seen, as, for example, in an approaching cloud, and some can be detected by their characteristic smell. Some are quickly dissipated and lose their effectiveness in as short a time as a few minutes; others persist—or can be made to persist—for a day or so; and the more persistent agents, either by nature or by the addition of thickeners, can last for a week, a month, or more, depending on the atmospheric conditions.

The chemical agents of greatest concern today are the nerve agents sarin, soman and VX, which attack the human nervous system, although older agents, such as mustard and hydrogen cyanide, have important military advantages and hence are serious threats in particular circumstances, some of which will be discussed below. Nerve agents can be absorbed as vapor through the respiratory system or directly through exposed skin that comes in contact with liquid agent droplets or concentrated vapor clouds. Even very small doses are sufficient to have an effect. Symptoms of nerve agent poisoning are a running nose, tightness in the chest, dimmed vision, difficult breathing, drooling, sweating, nausea, vomiting, cramps, twitching, jerking, headache, confusion, drowsiness, convulsions and, if a lethal dose has been absorbed, death. (Ref. 5, p. D-7) While the after-effects of the older, mustard-type agents are serious and usually permanent—and, in fact, the horror of these lasting effects may well be one of the major causes for the general repugnance about this type of warfare[5]—full recovery from less-than-lethal doses of today's

4. While biological weapons likewise attack only people, they are generally not viewed as *battlefield* weapons due to the time delay required before onset of effect.
5. Such an explanation, however, would hold in reverse as a factor in the Soviet emphasis on this type of warfare—in World War I the Soviets suffered almost as many chemical warfare fatalities and casualties as all other countries combined.

nerve agents is entirely possible. Such doses can put personnel out of action for days to weeks, however, depending on the amount of the dose and the medical treatment available, and thus would increase the military impact, both through preventing performance of military functions and, in addition, tying up many personnel in the administration of medical care for the incapacitated.

Chemical weapons are primarily tactical and can be delivered in a variety of munitions, such as land mines, artillery rounds, multiple-rocket launchers, tactical rockets such as the Soviet FROG, longer-range operational-tactical missiles such as the Soviet SCUD, cruise missiles, air-delivered short-range attack missiles, and bombs. In addition, agents can be sprayed by both land vehicles and airplanes and helicopters.

Chemical weapons are basically area munitions; they affect anyone who is not properly protected both at the time of agent delivery to the area or, in the case of areas attacked with the more persistent agents, anyone who subsequently enters the area without proper protection. The lethal areas associated with the employment of these munitions depend on the agent, on the number of munitions employed, with several munitions normally used to "blanket" the area of interest, and on a number of outside factors, such as weather, terrain, local vegetation, etc. Areas that one can efficiently attack with a single salvo of a few rounds of the larger weapons, i.e., bombs and missiles, may be roughly the size of a major logistics area, depot, or an airbase, and areas which might be attacked with a few battalion volleys of artillery might be the size of an anti-tank defense position.

Chemical weapons are particularly appropriate for use against facilities just prior to overrunning them, or when it would be desirable to capture and use particular assets, or in circumstances when continued offensive progress would be hampered by the rubble created by conventional or nuclear explosives. Not only different types of chemical agents but also specific agent/munition combinations are more or less useful for different purposes. A non-persistent agent attack would be logical in advance of an assault, for example, in a concentrated, surprise mode to cause heavy casualities at the position to be attacked. Multiple rockets, artillery, or tactical air might be the best mode of delivery for this purpose. A persistent agent, on the other hand, would most logically be employed to secure flanks or to block off routes of counter-attack, to "put out of action" bypassed urban areas, or to prevent the opponent's access to favorable ground or vital facilities—again, particularly those whose preservation for one's own use appeared necessary or desirable, such as rail or road networks or airfields. (Refs. 6 and 7, passim)

Atmospheric conditions are very important in determining the method of employment of chemical weapons and in predicting effects. Chemical agents drift

with the wind, and lower temperatures lower their evaporation rates; these sensitivities vary, depending upon the agent. According to the relevant Army Field Manual (Ref. 8), the meteorological conditions of interest are wind speed and direction, temperature, and atmospheric stability. Predictability of agent dissemination patterns and of the potential persistence of effects is an issue in determining the different agent/munition/target combinations of choice and the effects of use. While uncertainties exist, except for very high winds the weather conditions can be accounted for, and the type of agent selected and the weapons employed in such a manner as to take into account those conditions. This should not be considered as major an issue as it often is. Other factors, such as target location uncertainty, may well introduce more severe problems and apply to all weapons effects calculations. Minimizing the uncertainties associated with the behavior of chemical agents is largely a function of the attention paid to this matter.

Effectiveness of CW munitions can also be quite sensitive to the readiness of the unit under attack. Here, readiness includes the type of uniform, the capabilities of other individual and group protective equipment, decontamination capabilities, and, of exceptionally great importance, training in the use of available equipment. Chemical warfare is rather special in that considerable protection and readiness to cope with the resulting environment, while technically and physically demanding, can be achieved at relatively low cost. However, the measures that need to be undertaken are often extremely cumbersome and inconvenient. No one likes the idea of having to remain inside special clothing and to wear gas masks while fighting a war. The incentives and capabilities to do so require special emphasis on understanding the threat and on regular training in operating in a CW environment. Even with serious attention paid to these factors, a unit might well expect 5 to 15 percent casualties just from errors, oversights, or faulty equipment, e.g., a leaky overgarment or gas mask; however, that is much better than the heavy casualty level which might result from the only-marginally effective protective posture of both the current U.S. forces and most of the rest of the NATO forces[6] (Ref. 3, p. 90).

Considering the effects of chemical weapons throughout a target area, the ability of such agents to penetrate into trenches and buildings, and the "lasting" nature of their effects (if desired), chemical weapons should be recognized as very effective on a pound-for-pound basis. While they do different things, and hence are not directly comparable with conventional munitions, a rough estimate might well con-

6. Great variation in protection exists; according to Ref. 3, capabilities range from adequate to essentially none (p. 90).

sider them close to an order of magnitude more effective. During World War I, when chemical weapons were used extensively, they were judged to be between four and eight times as effective as high-explosive weapons (Ref. 9, p. 11–1 and Ref. 2, p. 30). Current chemical weapons should be considered significantly more effective in producing fatalities than World War I mustard and lewisite against similar levels of protection. In a sense they might more accurately be compared to nuclear weapons of a few kilotons yield, except without the attendant blast, thermal and atomic radiation effects. However, comparative effects calculations for chemical weapons which consider them in isolation are of limited utility because such weapons are often used in combination with others to achieve complementary benefits. Thus one should expect the use of different agents at the same time against one target and also expect the use of agents coupled with explosive and fragmentation weapons, thus enhancing the impact of both. This latter combination would be particularly synergistic in attacking most NATO operations complexes, considering the nature of the facilities and the lack of readiness of the personnel to deal with such combinations. For example, many buildings are relatively soft, that is, easy to puncture, and contaminated portions that would result from a combined conventional and chemical attack would be difficult to seal off. Another example: while NATO may be prepared to repair damage, e.g., craters in runways, it is not prepared if the area to be repaired is also contaminated.

The Current Soviet CW Posture

Chemical warfare clearly is a major contingency for which the Soviet Union plans. Capabilities for chemical warfare are serious and specialized, and are integrated throughout ground, air, and naval forces. The seriousness is demonstrated in force structure and personnel, equipment, training and testing, and agents and munitions. The overall Soviet capability to conduct chemical warfare has been termed "awesome" (Ref. 10, p. 22), and it is reportedly the "official Army position" today that there is a "considerable" chemical threat to NATO forces and that the Soviets are continuing to add to their CW capabilities (Ref. 6, p. 17).

Chemical defense units are organic to every Soviet command from front to regiment. Smaller units, even down to company size, have special Chemical Troops (Ref. 7, p. 3). There are "scores of Soviet generals and some 70,000–100,000 full-time chemical warfare officers and men" (Ref. 10, p. 22). (The United States has at most 2,000 officers and men engaged fulltime in some form of chemical chores, and, of these, probably no more than a small percentage could be regarded as equivalent.)

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Chemical warfare preparedness is also integral to the Soviet main fighting equipment. All modern tanks and armored personnel carriers (APCs) are designed to offer protection in both nuclear and chemical contaminated areas (Ref. 7, p. 3). The tank and armored personnel carrier protection includes integral "protective sealant liners," and air filters are provided which protect against chemical and biological contamination. The remainder of the new Soviet generation of fighting vehicles, including support vehicles, missile transporters, command vehicles, etc., are provided with supplies of individual protective equipment for the crews (Ref. 11 and Ref. 12).

There is also a considerable amount of issued individual protective equipment and equipment for decontamination. The soldiers all have personal masks, protective clothing, chemical detectors and "effective" atropine-based compound syringe antidotes (Ref. 7, p. 3, and Ref. 12).[7] Each Soviet division has decontamination companies which are to decontaminate and return to combat men and equipment. The specialized chemical decontamination equipment includes a unique type of vehicle called "TMS-65," a truck-mounted turbojet spraying apparatus for rapid decontamination of large vehicles (Ref. 7, p. 3). These capabilities do not appear to be merely defensive but appear designed and deployed for use as part of the Soviet offensive capability, i.e., to enable Soviet troops to exploit the results of the employment of their chemical weapons. While the Soviet protective clothing for the troops imposes considerable operating stress, as does the U.S. clothing, the current asymmetry in CW offensive capability means that the Soviets need have almost no fear of being subjected to contamination not of their own making. Hence, rather than being continuously on the alert and in their protective gear, they, unlike the U.S., would know when, where, and what agents are planned for employment. Thus, they would need to don the cumbersome gear only at essential times and places. Training in the use of the equipment for the purpose of fighting during chemical attack is standard and is emphasized in all individual and unit training (Ref. 7, p. 3), which, as a further indication of their seriousness, includes training in live agent environments (Ref. 3, p. 90).

The magnitude of Soviet attention to CW in the design of their forces was not clear to the U.S. defense community, despite the available intelligence material, until analysis of the Soviet actions during the 1973 Middle East War and analysis of the Warsaw Pact equipment captured during that war made many begin to question the appropriateness of the U.S. lack of attention. As indicated in Ref. 13,

7. Prompt use of antidotes can protect personnel against several times the nerve gas exposure that would otherwise be required for lethal effect.

information gathered from [that] Middle East War has emphasized that foremost among the potential adversaries of the United States in CW is the Soviet Union. Although the CW equipment they furnished in the October War was defensive, their forces are considered to be well-equipped for offensive and defensive CW operations. Evidence of CW delivery systems and weapons development, chemical, biological and radiological protective systems (CBR), realistic CBR training and civil CBR training support the fact that the Soviets can operate in a toxic environment.

The large amounts of Russian CBR equipment captured in the Middle East . . . reflect this capability and emphasize Soviet CW preparedness. As the Army's [then] Chief of Staff, Gen. Creighton W. Abrams, testified before Congress on 14 February [1974], the U.S. Army was surprised by the [CW preparedness of the] Arab forces, and is determined to improve its own CBR defenses. (pp. 21–22)

Analysis of captured assault equipment indicated that it had been designed to operate in a CW environment and that personnel had been provided with individual CW protective gear and antidote inoculants. From the universality of protective aspects of the captured weapons it was inferred that such protection on Soviet equipment was standard (Refs. 11 and 14). General Abrams, for example, said that he concluded that

chemical, biological and radiological defenses were now standard on all Soviet weapons and *thus* had been included on the equipment sent to Egypt and Syria. (Ref. 14, emphasis added.)

As to offensive capability, actual evidence is scarce. Knowledgeable persons, however, including Professor John Erickson of the University of Edinburgh (as quoted in Ref. 7, p. 3), have stated that Soviet chemical warfare agents include both World War I agents and more modern ones:

—mustard gases
—phosgene
—hydrogen cyanide
—soman
—other nerve gases
—an agent that "the Soviets label VR-55"

According to Erickson, chemical rounds exist for the 122-mm and 152-mm artillery, the FROG surface-to-surface short-range rocket, the longer-range SCUD surface-to-surface missile, and the BM-21 multiple rocket launcher (as quoted in Ref. 7, p. 4).

Chemical artillery, mortars, mines, air-delivered bombs and spray tanks were

in the Soviet inventory in World War II. There is no evidence that those munitions have been destroyed, and a similar pattern of weaponization can therefore logically be assumed for the post-World War II agents. A relatively more recent system, the BM-21 multiple rocket launcher, may well, as Erickson says, also have such rounds. It would be an ideal weapon system for delivery of a non-persistent agent, such as hydrogen cyanide. Because of the short lifetime of delivered toxic concentration, such an agent would be most useful against enemy forces immediately in front of forward-moving troops; occupation or assault of facilities attacked with such an agent can be carried out in a very short time after that attack with minimal danger to the assault troops. However, in the case of hydrogen cyanide in particular, this would not be very effective unless a lot of it were delivered to the target in a short time. Hence, the value of a multiple rocket launcher:

> The BM-21 . . . provides a multiple container for the agent, it insures effective and rapid distribution of the agent over a target area, and the round can release the agent in active form. A battalion volley can impact 720 rounds on a target. (Ref. 7, p. 3)

Soviet Rationale for Use

The potential Soviet use of chemicals in a major theater conflict which includes the use of nuclear weapons seems certain: there would be many advantages to the Soviets in hitting some targets without physically destroying them. And the impact of the use of chemicals on the likelihood of coupling to a strategic nuclear exchange might be viewed as minimal in that scenario: if escalation did not result from the use of theater nuclear weapons, it would be unlikely to result from the additional use of chemical weapons.

It is possible, however, that, should such a major theater war begin, the Soviets might favor keeping it conventional, at least for some period of time, if they believed that they could do so while still accomplishing their objectives. These objectives, relative to NATO in such a context, could be, first, to improve the position of the Soviet Union if the conflict should come to the point of a nuclear exchange (by reducing or eliminating the NATO nuclear capability), and, second, to quickly overrun NATO defense positions and seize critical territory. The primary problem in achieving the first objective would be the destruction or "putting out of action" of NATO nuclear forces—air capabilities, surface-to-surface missiles, artillery—and their associated command/control. The primary problems in achieving the second objective would be overrunning NATO anti-tank defenses, disabling NATO ground-attack tactical air, and inhibiting NATO force movements.

An important question here, particularly since the answer determines a great deal of the impetus or lack thereof in the U.S. programs to cope with a potential chemical threat, is whether chemical warfare agents would be employed by the Soviets in such a non-nuclear phase of conflict in Europe. The U.S. perception—both official and unofficial—for many years has been, and, for the most part, still is, that, given the Soviet definition of chemical weapons as "weapons of mass destruction," chemical warfare would only occur as part of a nuclear attack, whether that nuclear attack initiated a conflict or occurred at some later point. The present authors disagree. While it is clear that an important thread of the Soviet view of chemical and nuclear weapons is that the two are considered much alike, this thread by itself is a gross oversimplification and cannot and should not be relied upon to limit the type of conflict in which chemicals would be employed.

For the major Soviet concerns or targets in the event of either a conventional or a nuclear start to a war in Europe—NATO anti-tank defense; NATO nuclear capability, including command and control; NATO reserves; and NATO tactical air—chemical weapons in all cases offer important advantages that complement rather than duplicate the effectiveness of both conventional weapons and nuclear weapons, and recommend their use in both contexts. Without a good protective posture on the part of NATO, fast-acting chemical weapons could paralyze NATO anti-tank defenses without inhibiting Pact armor operations. Non-persistent agents, such as hydrogen cyanide, delivered by multiple rocket launchers, coupled with normal artillery preparation and smoke delivery, can effectively neutralize such defenses within a few minutes and be safe for Pact overrun some minutes later. Should nuclear weapons not be used, chemical weapons with persistent agents would likely be very important and effective for disabling NATO nuclear capabilities that are dispersed over areas, such as airbases and nuclear supply depots. Without a considerable protective posture on the NATO side, including decontamination capability, Soviet use of chemical weapons could put such bases out of action for extended periods of time with only a few repeated strikes with persistent chemical munitions. Many command/control targets, such as radars, ground control stations, navigation transmitters, and so forth, are neither large enough to warrant a nuclear strike nor vulnerable enough to be reliably destroyed with one sortie of conventional munitions. For such targets, generally unprotected against chemical agents, chemical weapons are the most efficient means of putting them out of action in a context of nuclear *or* conventional conflict.

Further, in both conventional and nuclear scenarios, it would be preferable from the Soviet point of view, to seize, rather than destroy, many targets including airbases, petroleum-oil-and-lubricant storage depots, and transport centers (har-

bors and airports). The objective is not to destroy these targets but merely prevent their use by U.S./NATO forces until the Soviets can seize them and put them to their own use—perhaps immediately, perhaps within a week or so (Ref. 15). In these cases, again, chemical weapons offer important and unique advantages; with selection of the proper agent, under conditions where the U.S. and other NATO forces have almost no decontamination capability, as today, such targets can be rendered unfit for NATO use but available for Soviet occupation and use at the planned time.

Finally, the movement of NATO reserves, which is already a severe problem given their deployment (Ref. 16, p. 19), could be seriously impeded by the application of the more persistent chemical weapons to important nodes.

The effectiveness of CW weapons can be especially high in exactly these mission areas because the desired results—disabling of the particular forces and contamination of particular areas—would not depend upon lethal doses of chemicals being delivered over the entire target. Sublethal dose areas that extend well beyond the lethal-dose areas will impose physically disabling effects on personnel who are not protected. These effects, in particular the optical pain and miosis[8] caused by small doses of nerve agent, will prevent or seriously degrade the performance of missions such as aiming, sighting, instrument reading, and flying, thus significantly increasing the effectiveness of these weapons beyond the usual estimates of effectiveness that are based only on the lethal areas.

All in all, chemical weapons offer very significant advantages to the Soviets in any kind of war, nuclear or conventional. Considering their advantages, many of which the Soviets obtain because of the "marginal" (Ref. 3, p. 91) U.S./NATO preparedness either to cope with such employments or to subject the Soviets to the same environment throughout the depth of their offensive deployment, it is inconceivable to the present authors that the Soviets would not capitalize on their capabilities. The benefits to be derived—disabling NATO tank defenses, paralyzing NATO nuclear capabilities, rendering inaccessible logistics areas and equipment depots, and hence greatly shortening the war—are far greater than any additional incremental risk or political cost associated with their employment over that of the war itself.

This conclusion is gradually gaining acceptance. The current Army Manual 100-5, the basic Army document on tactics, published in 1976, notes that the Soviets clearly have a *capability* to use chemicals in any level of conflict:

8. Miosis is contraction of the pupil of the eye, resulting in dimmed vision.

. . . Soviet or Soviet-equipped and trained forces *could* initiate and sustain large-scale CW operations in *either a conventional or conventional-nuclear conflict.* Their doctrine emphasizes the employment of chemical weapons in close coordination with conventional and nuclear weapons to capitalize on the attributes of each. (Ref. 9, p. 11–5, emphasis added.)

And this year's Department of Defense Annual Report (the Secretary's Posture Statement) goes a bit further and says that this capability is likely to be *considered* for use:

It is *likely* that the Soviets would *consider* using a combination of chemical and conventional weapons, as well as a combination of chemical, nuclear and conventional weapons—and *they have the capability to do either*—if they believed a significant tactical advantage could be gained. (Ref. 17, p. 157, emphasis added.)

The old *Penkovskiy Papers* book includes the statement: "let there be no doubt: if hostilities should erupt, the Soviet Army would use chemical weapons against its opponents" (Ref. 18, p. 249). Further, the *Papers* state that "the U.S.S.R. has already given political release for chemical weapons" (Ref. 18, p. 249). John Erickson has stated more explicitly that "Soviet division commanders have chemical weapons planning, release, and employment authority" (as quoted in Ref. 7, p. 3). It is the conclusion of the authors of this paper that if such delegation is assumed, use of chemicals should be considered a certainty early in any conflict. Further, even if such authority has not devolved, the Soviet use of chemical warfare during a conflict or a phase of a conflict limited otherwise to "conventional" weapons, *should not be discounted.* We agree with the statement that:

The Soviets are so immersed in chemical weaponry, tactics, doctrine, equipment and personnel, and so much of their training centers around the use of lethal agents, that it would be odd, from a military standpoint, if they did not employ them. (Ref. 10, p. 22)

Protective Aspects of the Current U.S. Posture

The U.S. posture to cope with a chemical attack was evaluated by the Army in 1975, by the Air Force in 1974, and by the Navy in 1977, in response to the concern over the threat which was generated as a result of the 1973 Mid-East War. These analyses showed that there was a great deal to be desired. The Soviet superiority over the United States in chemical warfare capabilities was assessed as considerable. However, not only was the imbalance serious at that time, but it has continued to grow.

Improvement programs in the Army and Air Force are now, belatedly, under way to ameliorate *some* of the deficiencies in their protective postures. The Navy appears less concerned. The "ultimate" goal of the Army and Air Force programs, toward which currently funded improvements are a first step, is for units to be protected sufficiently to continue sustained operations in a chemically contaminated environment, a capability for which, according to Ref. 3, the forces are "not prepared" today (p. 90). To first survive and then operate, the units as a whole, and the individuals separately, must be thoroughly trained in:

—Interpretation of intelligence and detection and warning data indicating chemical attack.
—Immediate actions necessary to protect against the agent.
—Reporting procedures to insure warning/notification of adjacent and higher elements.
—Operations in the appropriate protective posture.
—Recovery from the protective posture and resumption of normal operations.

In addition to the education and training implied by the above requirements, improving the defensive posture means provision for individual protective equipment, collective protection equipment for facilities, decontamination and evacuation equipment, and development of the proper procedures and the proper training for the use of these. Specialized units are needed to support operations in the contaminated environment and, therefore, some force structure changes will be required; regular and extensive training for all individuals and units in performing their normal mission operations in a contaminated environment is necessary; and equipment for the forces not only for both operational use but also for training use must be provided. Fortunately, such training can and, in fact, should, be primarily integrated training; the desired proficiency in operating in contamined environments must and can be achieved while performing other mission-related training tasks. And, further, while resources are required to accomplish all the above-listed tasks, a chemical warfare defense program does not involve large amounts of money. Much can be gained at relatively low cost.

Concurrent with initiating development of comprehensive doctrine and equipment procurement, the Army is also beginning to establish a chemical defense capability as part of an overall NBC (nuclear, biological and chemical) defense improvement at division level. The major effort here will be the provision of reconnaissance and decontamination support in the form of an NBC defense company which is to support the brigades of the division. This improvement is scheduled to provide support for forward Army units within the next year or two. As the Army

doctrinal work is completed, efforts will be expanded to include the necessary rear area support. In a related force-structure effort, the Army has reviewed staffing and recommends an addition of several thousand spaces to the total force for NBC defense. Procurement efforts are expanding to begin supplying the forward-based personnel with equipment.

The Air Force is also moving to establish some chemical warfare defense preparedness. Procurement of protective equipment is being accomplished. Priorities for equipment distribution for the Air Force are for in-place units in the high-threat areas; however, equipment is also being provided to CONUS Air Force bases for training purposes, and an Air Force-wide effort has been initiated to ensure that personnel receive adequate CW training. Additional manpower has been judged necessary to support the training and management of the additional equipment in the Air Force as well as in the Army. The Air Force gained 300 additional personnel authorizations for the disaster preparedness mission, which includes CW defense, in FY 77, and identified several hundred additional manpower authorizations believed necessary for the FY 79/83 period. (In the opinion of the present authors, the size of the immediate Army and Air Force manpower needs for CW defense are an indication of how bad the situation currently is.)

Both the Army and the Air Force have special problems in regard to the special protection requirements for pilots and crews. It is not likely that aircraft interiors can be kept free from agent contamination. Absorption of even very small quantities of nerve agent will cause miosis, thereby rendering the crew member virtually unable to fly his aircraft. For this reason, the Air Force has adopted a "dirty cockpit" concept, which requires that whole-body and eye/respiratory protection for air crews be provided in addition to normal flight gear. An ensemble has been developed for this purpose by the Air Force and when procured will be the first tactical-fighter qualified CW protective ensemble in the free world.

As all the armed services will admit, the task is by no means finished, and, in fact, is only barely getting under way. There is a great deal still to accomplish in all areas:

—Attention
—Awareness of the threat
—Personnel
—Material
—Doctrine
—Training
—Facilities

And progress seems interminably slow: procurement rates are such that equipment sufficient for more than a very limited survival time, and only limited operations during that time, will not be available until sometime in the mid-1980s; training depends on both equipment with which to train and qualified personnel to do the training and evaluation, and all progress in beginning training programs is being handicapped by the "insufficient issue of equipment" (Ref. 3, p. 90), by the personnel deficiencies, and by the general attitude of repugnance about CW that permeates the miiltary forces. Current training is described as "limited" and "usually rudimentary" (Ref. 3, p. 90).

Clearly, considerable integration and coordination is required in moving toward a uniform protective posture for our forces as a whole. Unfortunately for the coordination of both policy and program aspects of solving the problem, there are almost no focal points at significant levels in the services for force development, training, coordination, direction, or plans, and none in the Office of the Secretary of Defense. Responsibilities for CW defense generally are fragmented, left up to individuals at different levels to respond as they see fit, or at best, assigned as secondary responsibilities. The store is, in effect, left largely untended. Although the recent Army action to reestablish a CW focal point at the Departmental level is a significant step, it should be recognized that this was done by adding the CW responsibility to the existing position of nuclear responsibility. As recognized by the Marine Corps, "the defense against nuclear, biological, and chemical (NBC) attacks requires special consideration and training" (Ref. 19, p. 153). While such defense should not be viewed as "special," but rather should be considered an integral part of the standard posture, perhaps special coordination and integration of efforts to improve are temporarily warranted until considerably further progress is made in developing a momentum toward an integrated and adequate capability.

There is another aspect that must be considered as well. In warfare some of the personnel, no matter what the protective efforts, will suffer physical trauma. Medical evidence indicates that even a small, nonlethal dose of some agents can severely complicate other medical problems likely to occur. Agent effects can possibly inhibit necessary life-sustaining and recuperative mechanisms. Medical treatment, further, requires not only a biologically clean environment, but chemically safe surroundings as well. Even if a medical treatment facility were to remain initially uncontaminated, there is the problem of preventing secondary contamination, for example, from contaminated clothing that the victim is wearing at the time of entry into the treatment space. The limited number of medical personnel must be protected and yet still permitted to perform their mission. Many such issues are

still without solutions. Equipment and training can go a long way toward overcoming inherent design and use deficiencies, but further research, analysis, and development is clearly necessary to provide more answers and solutions.

We must meet the requirement of providing adequate protection, when feasible, to the officers and men of our armed forces. The complex systems used today, and those likely for the future, require skilled manpower that must spend a long time in the training pipeline. No matter how sophisticated the equipment, no matter what degree of automation it entails, we must continue to rely on people. They are an integral link in the systems of modern defense. The current and continuing climate of austerity points toward military forces of reduced size with reduced manning levels; hence, the importance of each individual, very specialized individuals with only minimal crosstrained backup, is growing. It is for the integrity of our forces that we must consider whether or not we are moving fast enough on defense against CW, as well as defense against the myriad other threats.

The value of each man is difficult to quantify. It may well be possible to place a dollar value on his salary, even, perhaps, on the expense of his long period of training. But it is beyond our capability to place a price tag on his services if, as a result of relatively simple and unopposed enemy action, he cannot continue effectively—and the result is a defeat.

Problems in Improving the U.S./NATO Posture

Despite the beginning of programs to improve the CW protection of the U.S. forces, the overall effort is limited and suffers from a serious sense of insecurity, and from concern over anything that might draw adverse publicity from the press, Congress, the arms control community, or academia. As explained to the authors by several senior U.S. officials, while the character and magnitude of the problem were clear, because of the political sensitivities associated with the topic, as one phrased it, he "could not stick his neck out." Furthermore, because of the low state of interest in and efforts focused on this area for a number of years, there have been relatively few persons thinking about the contributions that such protection could make to either deterrence or warfighting. Consequently, the value for deterrence and warfighting of improvements in the U.S. CW posture has not been convincingly articulated. This problem is demonstrated in the following passages:

There are statements in testimony, in field manuals, in CW studies and in war games which purport to show that CW has a high utility and that it could be a

decisive factor in future battles. But *the long-standing low state of both defensive and offensive CW capabilities in U.S. forces belies that conclusion. The low priority assigned to CW would be inexplicable if that were true.* (Ref. 20, p. 27, emphasis added.)

And,

In summary it can be said that the U.S. chemical warfare policy is stable, consistent with tradition and in general accord with the basic attitude of Americans towards chemical warfare . . . it can be said that a lingering ambiguity persists with respect to CW policy, as to whether a major chemical warfighting capability is required for an adequate U.S. national security posture. Because it has long been technologically feasible and financially possible to have such a capability, if deemed essential to cope with the threat of known major Soviet CW offensive and defensive capabilities and *in view of the apparent absence of such a U.S. capability* (as acknowledged in testimony before Congress), *it may reasonably be inferred that chemical warfighting is not an essential military requirement.* (Ref. 20, p. 41, emphasis added.)

Further, to be politically viable, any improvement program has to be strictly defense or protection oriented. At this time "efforts to improve the CW retaliatory capability have been halted" (Ref. 3, p. 91), despite the fact that U.S. policy allows for continued offensive capability for deterrence and to permit a reasonable degree of retaliation (Ref. 3, p. 90), and despite the fact that the current stockpile is "inadequate . . . becoming obsolete." (Ref. 3, p. 90)

The current policy of the United States regarding chemical and biological warfare was promulgated by the President on 25 November 1969. The policy objective was stated to be to deter the use of chemical weapons by other nations and to provide a retaliatory capability if deterrence fails. First use of chemical weapons and all use of biological weapons were renounced. In January, 1975 the U.S. ratified the 1925 Geneva Protocol which essentially contains the same chemical/biological policies as those unilaterally stated in 1969. Additionally, in April 1975, Executive Order 11850 extended the no-first-use policy to riot control agents and herbicides in war except for defensive purposes.

In May of 1977, a review of the chemical warfare policy and posture of the United States was directed by the President. This review resulted in a presidential decision which stipulated no immediate policy changes but called for another review of both the policy and posture in 1978, pending the outcome of another year's effort at the ongoing CW treaty negotiations in the Conference of the Committee on Disarmament (CCD) in Geneva. This decision appears to move the United States more seriously than ever toward negotiating a treaty banning chemical weapons,

if possible, despite the fact that there are still major points to be worked out in the on-going negotiations, involving both verifications measures[9] (Ref. 6, p. 20) and the sorts of items to be banned or limited (Ref. 2, p. 6). Meanwhile, the "halt" in any improvements in U.S. forces for CW retaliation-in-kind is, in the present authors' opinion, the result of a mistaken impression that such restraint might be reciprocated or is necessary to demonstrate to the Soviets the good U.S. intentions with respect to the on-going treaty negotiations.

Given the results of the 1977 review, it is not surprising that the few improvement programs are progressing so slowly. Chemical warfare preparedness, in general, has only recently benefitted from any attention at all; for most of the ten years since the Dugway test accident, as has been noted, it has been a neglected area, even compared to other neglected areas of security needs. While the Dugway accident served as a trigger, however, it was, the authors believe, only that; the reasons for neglect of this facet of warfare go much deeper. There are a number of causes, and they should be understood in detail, because they continue to affect the fragile impetus for improvement.

First, the neglect has occurred partly because the predominant U.S. assumption, given the Soviet definition of chemical weapons as "weapons of mass destruction," is that CW would be used by the U.S.S.R. only as an adjunct or supplement in a large scale theater nuclear conflict. In that case, the nuclear use is seen as dominant in terms of war conduct and outcome; chemical weapons are discounted as of relatively minor importance in that nuclear environment. Hence, the relative lack of preparedness in the chemical posture is not considered to seriously compound other preparatory oversights, such as maldeployment. Further, because the United States focus has been on deterring nuclear war, not on evolving a capability to fight it, U.S. nuclear capabilities are, according to this logic, not only the primary but also a sufficient deterrent by themselves. Chemical warfare preparedness is viewed as, at best, an unessential component of deterrence, and, at worst, a potential source of disaster. One example of the latter logic is:

> . . . Since nuclear weaponry, tactical or otherwise, is a built-in deterrent to war, it would make sense to reduce the number of other dangerous alternative weapons such as chemicals, lasers, and electromagnetic weaponry. With them out of the way, nuclear war conceivably could be less likely because fewer types of weapons

9. There is widespread agreement that a ban on chemical weapons is not fully verifiable without inspection measures so intrusive as probably to be both politically and commercially unacceptable. Among other reasons, this is because production facilities for chemical agents cannot be distinguished either from the air or from external ground inspection. (Ref. 21, pp. 323–326)

would be around for starting trouble with, thus risking escalation with nuclear weapons. (Ref. 6, p. 19.)

It is believed by the present authors that this approach only works if both sides concur. And, in contrast to the United States, the Soviets appear to view warfighting capabilities not only as a feasible but also as a principal objective of military preparation and, further, to view chemical offensive capabilities as a unique and extremely important aspect of that preparation for all modern warfare, be it nuclear or non-nuclear. As noted above, considering the potential benefits for the Soviets in using chemical agents in attack of air bases, in assaulting critical facilities and features of the terrain, in denying NATO use of nuclear weapons, and in disabling NATO anti-tank defenses in conjunction with conventional artillery and smoke, and the facts that all aspects of Soviet training—conventional as well as nuclear—emphasize operations in toxic environments and that chemical capabilities are integrated throughout their force structure, it appears entirely plausible that the Soviets intend far more than just retaining chemical weapons as an adjunct to nuclear weapons in a major war. There is clear evidence to suggest that the Soviets do distinguish between chemical and nuclear, that they have separated the two, and that chemical weapons are considered to have an effective and important role both in a nuclear conflict and in a conventional conflict. Further, because the use of such weapons in a conventional conflict, or in a conventional phase of a conflict, might satisfy multiple Soviet political and military objectives, such use must be considered plausible. Under this assumption, lack of U.S. preparedness for such an environment looks considerably more dangerous.

Second, U.S. repugnance and fear associated with the topic of chemical warfare and the mirror-imaging assumption that the Soviet Union shares this repugnance, permeates the political and defense establishment. Chemical warfare, curiously much more so than nuclear warfare, is termed "not chivalrous" and "bordering more on murder than on the killing according to the rules of warfare" (Ref. 6, p. 17). This fear and repugnance can be said to describe the traditional overall U.S. approach to CW, in contrast to an approach based on understanding.

At least part of this perspective appears to result from the strong memories of the World War I use of chemicals and the panics associated with those uses. Concern over such panics extended into World War II and provided an enlightening glimpse of the impact of this fear on actual combat capabilities. Although chemicals were officially not used, there was one cry of "gas" during the Omaha Beach invasion. This led to the loss of discipline and the complete disruption of command throughout an entire division, which subsequently was not reconstituted as an effective fighting force for three hours.

Part of the repugnance and fear may well have originated from a moral basis, and part of it has also probably derived from the simple pragmatic problem of fighting while wearing protective clothing and gas masks. The latter is viewed as a real ordeal that poses a major hindrance and presents severe training incentive problems, particularly in peacetime and when chemical weapons have not been used extensively for fifty years.

Additionally, there is considerable skepticism in the U.S. defense community as to the effectiveness of chemical weapons, and this, in turn, feeds the fear and repugnance. In arguing against the effectiveness of CW weapons, many people cite the problem of predicting coverage areas. As discussed above, this involves the effect of local meteorological conditions on the dispersal, settling, and evaporation of the chemicals. And, while it is true that there are uncertainties associated with planning CW employment, and some potential that such use might impact on the user's troops, the issues of "uniformity of effect" and "prediction of effect" should not be confused. The state of the art of prediction could be much further advanced in the United States than it is today. It is not, not because of limitations in the currently available U.S. analytical models and quantitative methodology to calculate effects areas, but rather because of lack of knowledge about the models and methods and lack of people to apply them (partially a result of the lack of priority and apathy about this subject and the resulting lack of effort). Such limitations need not be continued, however, nor do they imply that the weapon itself is any less effective. Other problems, which apply to all weapons, as noted above, may introduce more severe uncertainties than errors in estimating precise coverage or dose concentration contours. Also, the problem of the potential for variations in coverage that might impose a danger on friendly troops can be compensated for by selecting the proper delivery system and agent combination and by preparing the protective posture of one's own side, both to guard against unknown wind currents and drafts that may carry the agent back over the troops using it and to permit rapid movement through those areas over which the contamination has been disseminated. In general, the use of CW need not end up introducing any more unknowns than are already associated with normal conventional warfare and certainly far less than are associated with theater nuclear warfare.[10]

10. Among the more illuminating findings on the analysis and uncertainty problems associated with normally "well-understood" conventional war are the results that HERO has obtained in analyzing more than 100 engagements and campaigns of World War II and the Arab-Israeli Wars of 1967 and 1973. That study concludes, among other things, that there is "no apparent relationship between force ratios and rates of advance" (Ref. 22, p. 12).

The problem of skepticism about utility again has exacerbated the U.S. rejection of chemical warfare because of the U.S. propensity to mirror-image: because the United States does not believe CW weapons have military utility, the Soviets are viewed by some as rejecting an effective role for such weapons. Thus, according to this rationale, attention need not be paid to either offense or defense preparedness.

Again, it is believed by the authors that, while the repugnance and fear may be a perfectly reasonable view of the "immorality" of chemical warfare, the evidence is that the repugnance is *not* shared by the Soviet Union. The authors believe the evidence supports the interpretation that:

> Chemical warfare, to the Soviet leadership, is just another means of winning. This form of warfare holds for them none of the disgust and fear with which it is justly regarded in the West. (Ref. 2, p. 22)

Third, and closely related to the preceding problems, communicating the extent and significance of the Soviet CW threat and its import for the U.S./NATO posture has been and remains a significant problem. The basic problem here has not been one of lack of intelligence analyses. The fundamental problem has been that of communicating to an audience that basically has not wanted to "believe" or to address the problem in earnest, for the reasons cited in this section. In effect, it required the "hard" evidence of the actual, physical materiel captured during the Middle East War of 1973 to get some command attention. To a lesser extent, however, the problem is also generated by the limitations of scope and breadth of the analyses available on the threat and its impact as follows:

(1) Most of the threat analysis that has been available within the defense community has been, and is, largely technically oriented. The reporting of available data on stockpile of agents, systems for offense and protection, and order-of-battle tend to receive the emphasis. To develop a credible story, however, interpretation of the data, rationale for use, doctrine, potential employment plans, and most importantly, impact on U.S./NATO survival and operations is critical, and, generally speaking, has been least available.

(2) This is a result, in part, of the lack of priority assigned to this subject and, therefore, the number of experienced people that are charged with CW threat analysis. There are very few such people, only a handful, and the majority of these are technical specialists. It is no wonder, when these numbers are compared with the numbers of analysts devoted to other tasks, that the chemical warfare problem has not received the attention which it has deserved. The base for advocacy has been extremely limited.

(3) A further reason for limited communication of the threat has been the limited extent to which analyses are distributed, not only within the Department of Defense itself, and to other government agencies, but also to contractors, who play a major role in the U.S. national security decisionmaking process. While detailed information in its original form should rightly be restricted to a very small community, even the derivative analyses have had an extremely limited audience because of what have been, in the present authors' opinion, unnecessarily constraining levels of classification.

(4) An additional, and very important, part of the problem has been that the intelligence analysts concerned are, generally speaking, restricted by charter from looking at the U.S./NATO capabilities to cope with the imposition of the toxic environments which the threat could present. Hence, either they have not understood or they have been prohibited from including in their analyses consideration of the impact of threat use. It is only generation of and communication of that *impact* which could have and can now lead to further attention being paid to the available analyses and further efforts being allocated to generating other needed analyses.

(5) To the extent information on Soviet CW activities has been examined at all, moreover, the primary focus has been on CBR (chemical, biological, radiological) protection, and its "defensive" nature. And, given the common assumption that such weapons would only be used in nuclear conflict, the common view of a large-scale, highly destructive, nuclear war in Europe leading to "radioactive deserts" (Ref. 23, p. 40) had led to an interpretation that the large Warsaw Pact CW protective capabilities, training, etc., could well be primarily for anti-radiation and anti-fallout purposes. Again, the CW role has been largely dismissed.[11]

Fourth, the inherent U.S. belief in arms control and/or disarmament as a solution to military problems, and the resulting widespread assumption that the terms of the Geneva Protocol forbidding the first use of chemical weapons will be observed by the Soviet Union, has contributed to the paralysis in CW preparatory efforts by making preparations to cope with such use appear unnecessary, particularly in a time in which resources are severely limited. Likewise, the hopes for a new arms control treaty banning chemical weapons altogether have minimized incentives to solve the imbalance, as noted above, by halting improvements in the retaliatory posture, and have also reduced incentives to improve protection. How-

11. The authors believe that a widespread better understanding of the Soviet approach to war in Europe in a broad sense, as well as a better understanding of the resulting potential role for CW would help clarify the situation. For some ideas on the former, see, for example, Refs. 15 and 24.

ever, it is one contention of this article that depending on the goodwill of one's opponent in wartime, that is, assuming that the current in-force treaty which constrains only actions rather than capabilities will have any effect in a crunch, is unwise and may well lead to disastrous consequences. In fact, since 1925 two of the three uses of CW in conflict have been by signatories of the Geneva Convention against defenseless forces which had no capability for retaliation-in-kind.[12]

Allowing a potential treaty which is merely under discussion—and about which there is considerable fundamental disagreement between the negotiating parties as to terms and, in particular, verification provisions—to determine the U.S. posture at this stage makes a travesty of the arms control negotiation process. Arms control negotiation is meaningless if the Soviets can halt U.S. efforts to redress Soviet advantages merely through their continuing presence at the negotiating table, with no noticeable reins on their own programs. Further, while the proponents of a treaty such as that currently under negotiation will argue that the purpose of the treaty is to constrain capabilities by eliminating a class of weapons—unlike the Geneva Protocol—the authors believe that, because of the difficulties associated with verification, this purpose is simply unachievable. The security of our forces would again rest essentially on the goodwill and conscience of the Soviets to uphold their side of the bargain. The only Soviet motivation that the authors believe can reasonably explain the continuous Soviet interest in negotiating a chemical weapons ban is a deception or propaganda move whose objective is the continued debilitation of U.S. efforts to redress the balance, thus cementing an asymmetry in their favor. This would also mesh with and follow an apparent Soviet disinformation scheme designed to influence President Nixon to halt chemical and biological weapon development in 1969, as reported in Ref. 25. And the continued curtailing of any improvements in the U.S. CW retaliation areas is exactly what is happening.

A better approach to a two-aspect policy of arms control negotiations and necessary improvements was indicated by Brigadier General Lynwood B. Lennon, then Deputy Director of Strategy, Plans and Policy for the Army, as quoted in Ref. 6:

> Chemical warfare deterrence and chemical weapon arms control efforts are not mutually exclusive alternatives. Both can be pursued as prudent, logical, and complementary approaches to an eventual elimination of chemical warfare. *Near-term national and collective security requirements need not and should not be sacrificed*

12. The three uses were Italy against Ethiopia in 1935, Japan against China in the 1940s, and Egypt against Yemen in 1967. Japan had, at the time of use, not yet ratified the Convention; it did so in 1970.

to the allure of an illusive arms control agreement. The history of such negotiations seems clearly to reinforce the common sense notion that deterrence must continue *until an enforceable verifiable agreement can be reached.* (p. 17, emphasis added.)

Fifth, collateral changes in other aspects of the overall military balance—strategic nuclear, theater nuclear, conventional—may well have made the CW situation more important, and this appears not to be recognized. As force component balances shift, the relative positions of total force postures change, and the contribution of each aspect should be re-weighed. Changes in the nuclear balance, at both the strategic and theater levels, have perhaps weakened the extension of the nuclear deterrent umbrella over other types of conflict. Further, NATO nations have generally considered the option of increasing NATO's conventional warfare posture to match the Warsaw Pact conventional capability unrealistic; this deficiency was viewed for many years as offset by U.S. nuclear superiority. However, if that offset does not apply at all any more, and may well soon apply in the opposite direction, another serious asymmetry—in chemical warfare postures—may have a real impact on the delicate balance of deterrence and security.

In addition to a shift in the potential relative role of chemical warfare postures in the overall force balance, there have been changes in the CW posture balance itself, as discussed above; the asymmetry in the chemical warfare postures of the two sides has increased. Furthermore, in the opinion of these and other authors, the imbalance is continuing to grow (Ref. 3, p. 89) and may soon reach the stage where it becomes threatening to (1) our ability to survive in Europe, (2) our ability to fight in Europe, and (3) our ability to control escalation.

One of the more disconcerting aspects of chemical warfare is that the greatest advantages and incentives for the use of chemicals exist when there is a serious asymmetry in chemical warfare capability between the two opposing combatants. Historically, chemical weapons have been used only when such an imbalance existed; and, conversely, their use has in actuality been deterred when a balance in capabilities has been perceived by a potential user. The absence of any extensive use of gas in World War II is a good example of the deterrent value of an offensive symmetry—or perceived offensive symmetry. On both sides, the reason for not employing chemical weapons appears to have been a perception that the other side had an equal or better capability and, hence, the fear that retaliation would be severe and would undermine any advantages that the surprise first use might provide. In particular, the British considered using CW but decided not to because they thought—and correctly—that the German capability exceeded their own. At the same time, the Germans considered using CW but did not, because their intelli-

gence attributed a greater capability to the Western powers. (This particular German intelligence assessment was based on an analysis of the amount of U.S. research in the area of insecticides, particularly DDT. The abrupt cessation of publications about that research as the capabilities involved in the research moved to support the war effort was taken by the Germans to mean that the CW aspect of the research, i.e., nerve agents, had become a war priority.)

The impact of defensive postures depends, to a considerable extent, on the fact that chemical warfare agents as a class can largely be countered through the use of appropriate protective equipment, given adequate warning, training, and doctrine. In addition to the relative ease, technically, of developing such protection against chemical weapons, as compared with many other types of defense, it is not, as has been noted, particularly expensive to procure in adequate quantities. While a protective posture is unlikely to be perfect, it could have considerable effect, and, hence, would minimize the incentives for the use of chemicals, particularly for an attacker who is depending on speed for his own troops and who would be hampered at least somewhat if his own troops had to don their protective gear—whether to pass through self-imposed contamination or because of fear of retaliation.

In contrast, it is in a situation of asymmetry in both aspects that a user of CW can attain both maximum effect on his opponent and, because of minimum fear of retaliation in kind, a minimum hindrance of his own forces.

Recommended Actions

Thus, there appears to be a significant vulnerability in a critical aspect of U.S. and NATO military capability, and actions under way to reduce the present vulnerability do not match the seriousness of the threat. United States/NATO forces should expect to have a toxic environment forced on them, and, if they are not prepared to operate within such an environment and impose comparable problems on the Warsaw Pact forces, Soviet use would clearly have disastrous consequences for NATO.

Decisions on the importance of improvements in the chemical warfare posture will have to be made in the near future—that is, what budgetary and other priorities should be assigned to the solution of this problem, recognizing that improving the current U.S. position is not a "big money" question. Decisions are also needed on the value of arms control and disarmament measures which attempt to limit this area of military capabilities. It is important not to confuse a national policy of no first use and a national goal of effective arms control with the need to be able, first, to cope with the imposition of a toxic environment, and, second, to respond in kind

if and as long as that remains a U.S. policy option. At present the United States is not prepared to do either. And this imbalance tends to invite exactly that which should be avoided, that is, Soviet use of their chemical warfare superiority.

However, redressing the imbalance, or even understanding its implications, is not a short-term proposition. The protective posture improvements required cannot be accomplished by the mere infusion of funds to buy more masks and protective garments. What is required is a major change in attitude toward chemical munitions and an understanding of how to conduct operations in a toxic environment. Additionally, the issue of retaining, destroying or replacing the chemical munition stockpile is to be re-examined this year, after another year's experience in the ongoing arms control negotiations in Geneva. What is required here is a clear understanding of the risks of such a treaty as that now being discussed and the role of a retaliation-in-kind capability for both deterrence and warfighting.

Unusual attention and direction from the top in the Office of the Secretary of Defense and also in the armed services are now required to avoid continuing in this position of grave weakness vis-à-vis the Warsaw Pact forces. The first step should be to preserve those basic assets and experienced skills required to build a basis of understanding. Considerable data exist, together with a modicum of experts who have weathered the decline and fall of CW preparedness. Immediate attention and moderate funding are warranted to stabilize these capabilities and, using them as a base, to plan a rebuilding effort and establish priorities. The initial priority should be to build the foundation for a widespread understanding of chemical warfare and toxic environments.

Immediate actions that should be conducted within all agencies and appropriately coordinated and disseminated include, first, detailed analysis and evaluation of the total Soviet and Warsaw Pact CW offensive capabilities and employment strategy in both nuclear and conventional conflicts. This should be disseminated not just among people concerned with the CW area, but among all agencies and contractors whose concern includes some aspect of the posture in Europe. Second, and in parallel, analysis, test, and evaluation efforts should be undertaken to understand the impact of different dose level exposures, particularly low-level exposures, on the operation and effectiveness of weapons systems and on the performance of military missions; these efforts should also examine how military operations might be conducted when toxic environments are imposed on various force elements, installations, or areas. Third, considerable work is required to rethink the problem of deterrence of and response to the use of chemical weapons in a conventional

conflict. Today, the only "solution," given the asymmetry and the paralysis resulting from the arms control efforts, appears to be to depend upon tactical nuclear weapons to deter the employment of chemical weapons—an interesting peacetime alternative, but one that will be of little comfort in a crisis.

Until these problems are addressed in considerable depth, the United States should not curtail CW activities out of a "spirit of the negotiations" and, in negotiating, should not continue to unilaterally constrain its security choices. A ban on chemical munitions, for example, would eliminate the option of retaining a U.S. CW retaliatory capability. Unless it were adequately verified, which certainly appears to be impossible today, the ban would not constrain the Soviets from continuing to upgrade their already formidable capability. We hope that the 1978 review called for by the President will examine the entire range of CW-related security issues.

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