Chemical and Biological Warfare (II): The Weapons and the Policies

Until I retired . . . I was not able to speak of a chemical or biological weapon without prefacing my remarks with the statement that the enemy might use it. I was never able to speak of the offensive, only of the defensive.—Brig. Gen. J. H. Rothschild, USA (Ret.), former Commanding General, U.S. Army Chemical Corps Research and Development Command, *Tomorrow's Weapons* (McGraw-Hill, New York, 1964).

The United States' program in chemical and biological weapons does not stop in the laboratory. Weapons are accumulating and military manuals describe in detail a variety of circumstances and conditions in which they might be used.

It has to be remembered that, because of restrictions in the government's information policy, a great deal of data would probably be held just as secret if CBW production were floundering as if it were successful. Nevertheless, although the magnitude and precise ingredients of the CBW arsenal cannot be known by those outside the security establishment, the weapons-production program does support an apparatus of several thousand people.

Fort Detrick, in addition to its research activities, is involved in process development, small-scale production, and design and operation of pilot plants. Closely related to Detrick is the Dugway Proving Ground, which employs about 900 people and occupies an area in Utah larger than the state of Rhode Island. Dugway is the principal station for field assessment and testing of chemical and biological munitions.

According to Pentagon officials, there is no large-scale field testing of chemical and biological agents on human subjects. Limited testing is done on volunteers at Detrick—Seventh Day Adventists who serve in the Armed Forces only as noncombatants—and occasional experiments have been performed on prisoners. But the military logic of real testing is evidently outweighed by fear of injury and contamination, and field trials are reportedly limited to animals or to nonpathogenic simulated agents. (During World War II the British conducted BW experiments with anthrax—spores of which remain in soil for a long time—on the small island of Gruinard, off the northwest coast of Scotland. According to a recent statement by G. E. Gordon Smith, director of Porton, the British equivalent of Detrick, when the island was recently revisited it was concluded that "it may remain infected for 100 years.")

Biological munitions are produced at Pine Bluff Arsenal, a 15,000-acre installation outside Pine Bluff, Arkansas, which employs about 1400 people. Pine Bluff also produces toxic-chemical munitions and riot-control munitions. Its job runs from manufacturing the agents to filling and assembling weapons. Research and development on chemical weapons, and some production and assembly of them, take place in a number of subunits of the Edgewood Arsenal, in Maryland. Various chemical munitions, reportedly including nerve gas, mustard gas, "incapacitants," and anticrop weapons, are produced at Rocky Mountain Arsenal in Denver. The U.S. also operates a major manufacturing plant—at an estimated annual cost of $3.5 million—in Newport, Indiana, where Sarin, a lethal nerve gas, is produced and loaded into rockets, land mines, and artillery shells. The plant is managed under contract by the Food Machinery Corporation, has 300 employees, and is reported to have been operating 24 hours daily since 1960. Additional chemicals were manufactured during the middle 1950's at another plant in Muscle Shoals, Alabama. A few years ago the Pentagon entered into contracts with about ten chemical companies for research and development on improved defoliants and desiccants; the chemical defoliants used in Vietnam are for the most part purchased commercially.

Chemical weapons are produced in forms designed to meet the requirements of all services. They are available in a variety of forms from regular artillery shells to the Sergeant missile (which has a range of 139 km), the Honest John and Little John rockets, and chemical land mines. They are also available as bombs for delivery by conventional military aircraft. Detailed information on delivery systems for biological agents is classified, but unclassified manuals suggest that biological weapons are available as warheads for missile systems (for large-area attacks), as cluster bombs, and as spray tanks and dispensers mounted on aircraft. (In his book promoting CBW, General Rothschild qualifies his discussion of the availability of chemical and biological weapons with these words: "Whether or not they have been procured in sufficient quantity for combat use is another matter. However, this information cannot be released to the public.")

Useful attributes of chemical and biological agents, from a military point of view, are that they can penetrate structures, cover large areas, and produce a range of effects for varying periods—severe illness for a brief time or less-severe illness for a long time, tears or hallucinations, paralysis or death. A useful quality of biological weapons, according to the unclassified military field manual *FM 3-10*, is their ability to "accomplish their effects . . . with little or no physical destruction. This constitutes an advantage both in combat operations . . . and—from a longer range viewpoint—in postwar rehabilitation, where overall rebuilding requirements would be reduced." The utility of chemical weapons is described in similar language. (The manual, entitled *Employment of Chemical and Biological Agents*, has classified counterparts.)

The Chemical Arsenal

Components of the arsenal change from time to time, reflecting both technical progress and military judgment. The current manual lists seven chemical agents now standardized for use. They include two nerve agents, one blister agent, an incapacitant, a vomiting agent, and two riot-control agents.

The nerve gases were discovered in Germany in the course of research on insecticides. At the end of World War II the Russians captured a German plant that manufactured Tabun, a highly toxic chemical known by the military symbol GA. They moved the plant to Russia, and are said to have

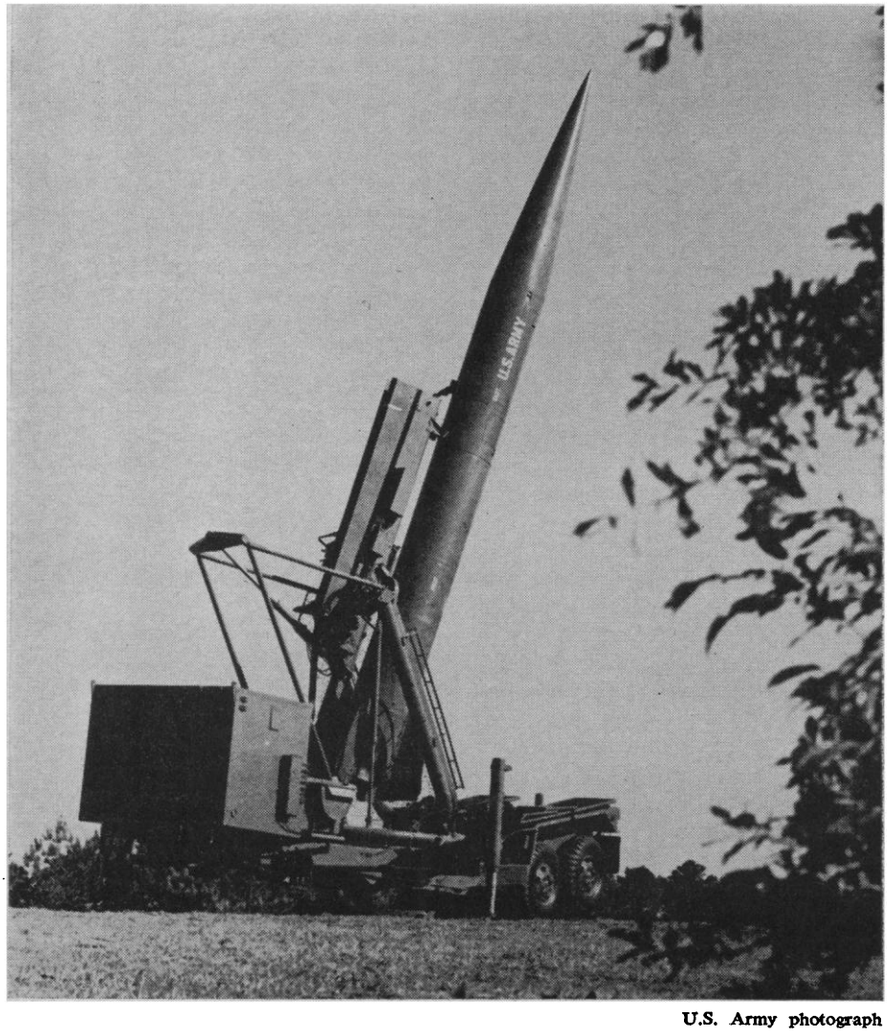
made Tabun their standard nerve agent. The United States adopted a related chemical, Sarin, known as GB, which is said to be four times as toxic as Tabun and 30 times as toxic as the previously favored lethal agent, phosgene. Sarin is colorless, odorless, and poisonous in minute quantities. According to the Army technical manual *TM 3-215, Military Chemistry and Chemical Agents*, its effects, in order of appearance, are:

> . . . running nose; tightness of chest; dimness of vision and pinpointing of the eye pupils; difficulty in breathing; drooling and excessive sweating; nausea, vomiting, cramps, and involuntary defecation and urination; twitching, jerking, and staggering; and headache, confusion, drowsiness, coma, and convulsion. These symptoms are followed by cessation of breathing and death. . . . Although skin absorption great enough to cause death may occur in 1 or 2 minutes, death may be delayed for 1 or 2 hours. Respiratory lethal doses kill in 1 to 10 minutes, and liquid in the eye kills nearly as rapidly.

The other standard nerve gas, VX, is of the same general type as GB and has similar effects, but it evaporates more slowly and therefore remains effective longer.

The blister agent available for use is distilled mustard, or HD, a purified version of the mustard gas used in World War I. Moderate concentrations of mustard burn the eyes and produce skin irritation that may include blistering and ulceration. High concentrations may have systemic effects—nausea, vomiting, cardiac arrythmia, and shock. Long-term effects may include aplasia of bone marrow, dissolution of lymphoid tissue, and ulceration of the gastrointestinal tract.

Both the nerve gases and distilled mustard are recommended for use to cause direct casualties, to harass the enemy by forcing troops to wear protective clothing ("thereby impairing his effectiveness as a result of fatigue, heat stress, discomfort, and decrease in perception"), and to hamper or restrict the use of terrain. They may also be used to complement other munitions, or for, among other purposes, "engaging numerous small, individual targets not militarily worth the use of a nuclear munition."



U.S. Army photograph

The Sergeant missile, with a range of 139 kilometers, carries warheads filled with the nerve gas GB.

"Incaps"

Research on incapacitating chemicals, known informally to some CBW researchers as "incaps," began in the middle 1950's, with emphasis on consciousness-altering drugs, or hallucinogens. In 1964, General Rothschild remained enthusiastic. "Think of the effects of using [LSD-25] covertly on a higher headquarters of a military unit or overtly on a large organization!" he says in *Tomorrow's Weapons*. "Some military leaders feel that we should not consider using these materials because we do not know exactly what will happen and no clear-cut results can be predicted. But imagine where science would be today if the reaction to trying anything new had been 'Let's not try it until we know what the results will be.'" However, fear of inducing irrational and unpredictable behavior in an enemy—especially one who controls nuclear weapons—evidently outran scientific curiosity. Research shifted to agents causing temporary physical disability such as discomfort, anesthesia, paralysis, or immobility. One compound reportedly regarded as promising produces temporary ascending paralysis. The victim first loses the ability to stand, then becomes unable to move his arms. He remains alive but cannot fire a weapon or otherwise function in a military capacity.

The incapacitant now standardized for use is known as BZ. It has both physical and mental effects, but its precise nature is not clear; unclassified information is notably less ample than for other chemical agents. The Army technical manual *(TM 3-215)* lists the following effects: interference with ordinary activity; dry, flushed skin; tachycardia; urinary retention; constipation; slowing of physical and mental activity; headache; giddiness; disorientation; hallucinations; drowsiness; maniacal behavior (sometimes); and increase in body temperature. The weapons-employment manual warns that there are "critical limitations to the use of BZ" but cites the usefulness of incapacitants against intermingled enemy and friendly military units and against mixed populations of friendly, enemy, and civilian personnel.

The three remaining agents are sometimes placed together in the "riot control" category, although one—DM—is a vomiting agent. It causes sneezing and coughing, nausea, vomiting, severe headache, and acute pain and tightness in the chest; symptoms may last up to 3 hours. Another agent, CS, is one of the more recently developed agents of the general tear-gas type. It causes extreme burning and tearing of the eyes, difficulty in breathing, tightness of the chest, stinging of the skin, running nose, dizziness, and—in heavy concentrations—nausea and vomiting. The third, CN, has effects generally like those of CS, but it also causes burning, itching, and, occasionally, blisters. Effects of these two agents last for a few minutes.

The agent DM alone "is not approved for use in . . . any [riot-control] operation where deaths are not acceptable." However, the field manual reports that it may be used combined in munitions with CN and in "military or paramilitary operations, in counterinsurgency operations, or in limited or general war . . . where possible deaths are acceptable." Chemical agents CN and CS may be used to flush "unmasked enemy troops from concealed or protected positions, to reduce their ability to maneuver or use their weapons, and to facilitate their capture or their neutralization by other weapons." They are also regarded as useful "in the conduct of raids and ambushes against guerrilla forces and in defense against insurgent or guerrilla attacks and ambushes." All three, DM, CS, and CN, have been authorized for use—and used in many of these ways—in Vietnam.

Biological Possibilities

The identity of the biological agents standardized for use is classified, but unclassified references testify to their existence. Characteristics of the diseases that might be employed vary considerably. Brucellosis (undulant fever), for example, begins with aching, headache, loss of appetite, and stiffness, and produces constipation, loss of weight, and fever accompanied by severe sweating. It lasts for months and sometimes years, and may produce severe depression. Tularemia (rabbit fever) is characterized by sudden onset of chills, nausea, vomiting, fever, and prostration; it sometimes produces ulcerations and pneumonic complications, and may become a chronic condition. Mortality of untreated victims is as high as 30 percent. Rocky Mountain spotted fever is an acute infectious disease producing fever, joint and muscular pains, aversion to light, and sometimes delirium, coma, convulsions, tremors, muscular rigidity, and jaundice. Persistent effects may include deafness, impaired vision, and anemia. Mortality in untreated cases averages about 20 percent but can run as high as 80 percent. Psittacosis, or parrot fever, causes acute pulmonary infection, chills, fever, sore throat, constipation, weakness, and, sometimes, delirium. Mortality in untreated cases is about 10 percent; death is more common among persons over 30. Coccidioidomycosis occurs as an acute, disabling disease resembling flu, and as a chronic malignant infection that may involve any or all organs—including skin and bones—and produces abscesses. From the second form, mortality is about 50 percent. Botulism poisoning produces vomiting, constipation, thirst, weakness, headache, fever, dizziness, double vision, and dilation of the pupils. In the United States, death occurs in about 65 percent of the cases.

Particular diseases are not recommended for particular uses in unclassified Army publications, but the anti-civilian character of biological weaponry is suggested: "While these agents might be employed against selected individuals, their main value appears to lie in producing mass casualties over large areas with resultant physical and psychological effects that could weaken or destroy the target group's ability to wage war."

USAF photograph

The U.S. Air Force released this picture with the following caption: "Jungle Spraying—Three U.S. Air Force UC-123 Providers spray defoliant chemicals on the dense Vietnamese jungle. Harmless to human and animal life, the chemicals are temporarily effective against the dense vegetation which may be shielding enemy troops from aerial view. The spray increases visibility by 50 percent within a few weeks." No explanation was offered for the fact that the planes appear to be spraying open fields.

Projections of the military utility of chemical and biological weapons now in the arsenal are not based on experience. Chinese allegations that the United States used biological weapons in Korea were never substantiated. During the Korean war some U.S. commanders sought permission to use chemical agents; they were refused, and after the war did considerable public griping. Riot control agents were used against North Korean prisoners of war during outbreaks in POW camps, however, which may have been the source of stories that chemicals were employed in combat. In addition, American planes are reported to have dropped propaganda leaflets in converted gas cannisters that were left over from earlier wars.

The Italians used mustard gas against the Ethiopians in 1936, and the Japanese are believed to have used chemicals against the Chinese between 1937 and 1943. But apart from these cases there are no authenticated instances of intentionally lethal chemical gases being employed since World War I, and there are no authenticated instances of modern use of biological weapons.

U.S. Policies

According to the unclassified field manual *FM 3-10*, "the decision to employ lethal or incapacitating chemical or biological agents is a matter of national policy." That policy is now in a somewhat unsettled state.

During the 1920's the United States took the lead in promoting international prohibitions of chemical and biological warfare. One effort, the 1922 Treaty of Washington outlawing "the use in war of asphyxiating, poisonous or other gases" was ratified by the U.S. Senate but rejected by France because of provisions, unrelated to chemical warfare, that placed strict limitations on submarines. The treaty never went into effect. In 1925 the United States tried again with the Geneva Protocol, which repeated the earlier ban on chemical weapons and added a prohibition of "bacteriological warfare." It was sent to the Senate in January 1926, where it met a returning wave of isolationism and a wall of opposition led by the American Legion and the American Chemical Society. A majority of the Senate became convinced of the need to keep the CBW option open and to avoid offending the treaty's enemies. The Geneva Protocol was returned to the Senate Foreign Relations Committee and never again emerged.

Since that time, American rejection

CBW, Vietnam Evoke Scientist's Concern

In recent months thousands of scientists have signed a petition to President Johnson urging an "end to the employment of anti-personnel and anti-crop chemical weapons in Vietnam." The petition was initiated last September by 22 leading scientists including John Edsall, Felix Bloch, Paul Doty, Robert Hofstadter, and E. L. Tatum (*Science*, 23 September 1966); it will probably be presented to the President shortly. Addressed chiefly to the risks of escalation, the petition states that

> CB weapons have the potential of inflicting, especially on civilians, enormous devastation and death which may be unpredictable in scope and intensity; they could become far cheaper and easier to produce than nuclear weapons, thereby placing great mass destructive power within reach of nations not now possessing it; they lend themselves to use by leadership that may be desperate, irresponsible, or unscrupulous. . . . U.S. forces have begun the large-scale use of anticrop and "non-lethal" antipersonnel chemical weapons in Vietnam. We believe that this sets a dangerous precedent, with long term hazards far outweighing any short term military advantage. The employment of any one CB weapon weakens the barriers to the use of others. No lasting distinction seems possible between incapacitating and lethal weapons or between chemical and biological warfare. The great variety of possible agents forms a continuous spectrum from the temporarily incapacitating to the highly lethal. If the restraints on the use of one kind of CB weapon are broken down, the use of others will be encouraged.

A number of scientific societies—including the American Anthropological Association, the American Association for the Advancement of Science, the Federation of American Scientists, and Physicians for Social Responsibility—have passed resolutions or taken other action expressing concern over or opposition to CBW. In addition, many individual protests have appeared in a variety of publications, and there have been series of private communications from distinguished scientists to the President and other government officials. In one such instance, 12 plant physiologists, arguing from the basis of "special knowledge of the effects of chemicals on plants," wrote to the President that the persistence of some defoliants is such "that productive agriculture may be prevented for some years," and that "massive use of chemical herbicides can upset the ecology of an entire region."

Most recently, distress about the effects of war—though not specifically about CBW—is evident in the formation of a new group known as the Committee of Responsibility to Save War-Burned and War-Injured Vietnamese Children.* The committee, whose sponsors include more than 60 well-known scientists and physicians as well as a number of clergymen and other public figures, plans to raise private funds to bring Vietnamese children injured in the war to the United States for medical treatment. Honorary chairmen include Bentley Glass, Albert Sabin, Benjamin Spock, and Helen Taussig. Other scientists associated with the effort include Edward Condon, Hudson Hoagland, Salvador Luria, and Anatol Rapoport.

Finally, a group of scientists growing out of the Pugwash movement have recently begun investigation of the problems and possibilities of biological weapons disarmament. These efforts are on a modest scale, consisting chiefly of exploratory research into the matter of what questions regarding biological disarmament need to be studied. Financial assistance for an expanded research effort may be forthcoming from the Stockholm International Peace Research Institute, an organization established last year by a grant from the Swedish Parliament. SIPRI has already expressed considerable interest in such studies.—E.L.

*The committee's address is 777 United Nations Plaza, New York 10017.

of chemical and biological warfare has rested chiefly on a statement issued by President Roosevelt in 1943:

> From time to time since the present war began there have been reports that one or more of the Axis powers were seriously contemplating use of poisonous or noxious gases or other inhumane devices of warfare. I have been loath to believe that any nation, even our present enemies, could or would be willing to loose upon mankind such terrible and inhumane weapons. . . . Use of such weapons has been outlawed by the general opinion of civilized mankind. This country has not used them, and I hope that we will never be compelled to use them. I state categorically that we shall under no circumstances resort to the use of such weapons unless they are first used by our enemies.

This policy was fortified by the universal abstention from CBW in World War II, and by U.S. restraint in Korea. Roosevelt's statement was reaffirmed in January 1960 by President Eisenhower, who said, in response to a question at a press conference, "so far as my own instinct is concerned, [it] is not to start such a thing as that first."

Even while Eisenhower was speaking, however, wheels were already turning in other directions. In September 1959 Representative Robert W. Kastenmeier (D-Wis.), alarmed by the Army's emerging CBW campaign, proposed that Congress adopt a resolution opposing first use of these weapons. The resolution, its language echoing Roosevelt's, said:

> Congress hereby reaffirms the longstanding policy of the United States that in the event of a war the United States shall under no circumstances resort to the use of poisonous or obnoxious gases unless they are first used by our enemies.

Kastenmeier's resolution was opposed by the State and Defense departments in September 1960 in language that testified to the reevaluation that was under way, and on grounds remarkable for their avoidance of the "first use" issue. According to the State Department, in its official response to the resolution:

> As a member of the United Nations the United States . . . is committed to refrain from the use not only of biological and chemical weapons, but the use of force of any kind in a manner contrary to that Organization's Charter. Moreover, the United States is continuing its efforts to control weapons through enforceable international disarmament agreements. Of course, we must recognize our responsibilities toward our own and the Free World's security. These responsibilities involve, among other things, the maintenance of an adequate defensive posture across the entire weapons spectrum, which will allow us to defend against acts of aggression in such a manner as the President may direct. Accordingly, the Department believes that the resolution should not be adopted.

The Pentagon said:

> It must be considered that biological and chemical weapons might be used with great effect against the United States in a future conflict. Available evidence indicates that other countries, including Communist regimes, are actively pursuing programs in this field. Moreover, as research continues, there is increasing evidence that some forms of these weapons, differing from previous forms, could be effectively used for defensive purposes with minimum collateral consequences. These considerations argue strongly against the proposed resolution, which appears to introduce uncertainty into the necessary planning of the Department of Defense in preparing to meet possible hostile action of all kinds.

Most recent official statements on CBW have arisen in the context of Vietnam. In a news conference held in March 1965, Secretary of State Dean Rusk told reporters, "We are not engaged in gas warfare. It is against our policy to do so. . . ." At about the same time, Deputy Defense Secretary Cyrus Vance wrote to Representative Kastenmeier that "national policy does proscribe the first use of lethal gas." In addition, the United States last month went along with a move of the United Nations General Assembly, initiated by Hungary, and endorsed a resolution calling for strict observance by all states of the principles of the Geneva Protocol. (Hungary's original version, which also condemned "any actions aimed at the use of chemical and bacteriological weapons" and termed their use an "international crime," was opposed by the U.S. as "subject to contention, misinterpretation, and distortion.")

These statements by U.S. officials have had a common theme. The Johnson administration maintains that its operations in Vietnam do not involve the "asphyxiating, poisonous, or other gases" outlawed by the Geneva Protocol, and that they do not constitute "chemical and biological warfare." Whether they do or not is something that scholars of international law can perhaps argue in many ways. But it has to be faced that despite their civilian analogues—to which the administration repeatedly has called attention—the destruction of crops by chemical or biological means, and the use of nonlethal chemicals to achieve military objectives, fit in naturally with most descriptions of CBW written before current operations in Vietnam began.

According to the latest information supplied by the Pentagon on request from *Science*, more than 500,000 acres of jungle and brush and more than 150,000 acres of cropland have been, in DOD's language, "treated with herbicides." While the Pentagon points out that this area is a negligible fraction of Vietnam's arable land, the program is now tripling in capacity, to 18 planes. (Correspondents in Vietnam report that, lettered above a room in the headquarters of the men who fly the missions is a motto: *Only We Can Prevent Forests.*) In other operations, the use of what the Pentagon still terms "riot control agents," after a period of being closely monitored in Washington, has passed to the initiative of local commanders. The Pentagon told *Science* that it no longer knows how many times and for what purposes they have been employed.

Apart from Vietnam itself, and the issues, raised by many scientists, of the effects of these chemicals on Vietnamese civilians and on the countryside, there is another question: Will what we are doing there, however the government chooses to label it, lead to further CBW operations—by the U.S. or by others, during this war or the next—about whose character there could be no semantic quibble? Officials of the Pentagon and the State Department deny that we are setting a precedent or that there is a risk of escalation. On historical grounds alone, their position is weak. The first use of gas in World War I was not the German attack with chlorine in 1915 but a French attack in 1914—with tear gas. United States officials find the Vietnam war an especially bitter and frustrating one. There is constant search for a technological breakthrough—with some suggestions bordering on the bizarre—that will produce a political victory in the fight against elusive guerrillas. We appear headed for involvement in guerrilla warfare for a long time. Proposals to reach further into the waiting CBW arsenal provided by research have traveled high into the Pentagon. Until now they have been resisted. But, if the record of the Vietnam war demonstrates anything, it is that frustration and a sense of futility can make even desperate measures seem attractive. What is "unthinkable" at one moment may be policy the next.

—ELINOR LANGER

(This is the second of two articles on chemical and biological warfare.)