of the Senate Foreign Relations Committee in 1960.

As evidence of the immediate relevance of this issue I would point out to my colleagues reports of the use of chemical and biological warfare weapons in Vietnam. I include in the RECORD today articles on this activity by former Associated Press Pentagon correspondent Seymour Hersh which appeared in the April 25, and May 9, 1968, issues of the New York Review of Books. I also insert another article by Mr. Hersh on this subject from the August 25, 1968, New York Times magazine. In addition, I call the attention of my colleagues to a two-part series by Elinor Langer which appeared in the January 13 and 20, 1967, issues of Science magazine. The fact that Miss Langer's articles were written over 2 years ago indicates the length of time the Pentagon's chemical and biological warfare program has been documented in the public record.

I call upon the Congress to initiate an immediate full-scale congressional probe into the Pentagon's development and production of chemical and biological warfare weapons. The dangers posed by the production and transfer of these weapons demand that the Congress respond to this problem by making a full investigation of this area of Pentagon research. Annual expressions of surprise and shock will not get to the root of the problem. I urge the Congress to initiate the full-scale inquiry I first advocated almost 1 year ago.

The articles follow:

[From the New York Review of Books, Apr. 25, 1968]

1968

OUR CHEMICAL WAR

(By Seymour M. Hersh)

Late in 1961, a Defense Department official was making his first trip to South Vietnam. The defoliation program, aimed at destroying jungle used by the Viet Cong for cover, had begun in October and the official planned to take a firsthand look. He later gave a briefing to Premier Ngo Dinh Diem. Diem "pulled out a tremendous map and began to give me a briefing on how much land the Viet Cong controlled in the South," the official recalled. "I found out later it probably was a standard briefing he gave to all visiting officials."

Diem's point was that the use of defoliants to deny the enemy jungle cover was well and good, but to be really effective the chemicals had to be used against the Viet Cong's crops. "This wasn't what we wanted," the Pentagon official said, "but we started using the stuff for crop killing. At first I insisted a Vietnamese officer go along to identify the target as Viet Cong-controlled, but this eventually was prostituted." The whole incident left him disconcerned, the official said.

Early in February, 1962, the Soviet Union accused the United States of waging chemical warfare in South Vitnam. *Izvestia* reported that "the Pentagon has marked the beginning of the new year by an unprecedented action: the use of chemical weapons." It said US airplanes were defoliating jungles and added: "The Air Force even started to destroy by poisonous gas the crops on the peasants' fields in the regions where dissatisfaction is spreading." The article added that the important thing is not the extent of US use of gas warfare, "but the fact itself that an established principle has been violated." *The New York Times* subsequently reported that the United States had turned down a South Vietnamese request to starve out the Communist guerrillas by spraying defoliants and herbicides on food crops. The dispatch noted that "the reluctance to join the crop-killing program urged by the South Vietnamese is believed based on American sensitivity to the possibility that accusations would be made that Americans took part in chemical warfare."

The story was technically correct; US planes were not then directly involved in the specific spraying of food crops (although American defoliation missions against jungle growth along highways had begun). What the *Times* story did not say, however, is that by the end of November, 1961, according to *Newsweek* Magazine, American special warfare troops had begun teaching Vietnamese fliers how to spray "Communist-held areas with a chemical that turns the rice fields yellow, killing *any crop* being grown in rebel strongholds [my emphasis]." By early 1963, according to United Press International and the *Minneapolis Tribune*, the Vietnamese Air Force helicopters and planes were regularly using American defoliants and herbicides to destroy crops in Viet Cong territory.

Charles E. Smith, Saigon correspondent for UPI, wrote on March 16, 1963, that chemical defoliants and herbicides "are used in certain places in the central highlands were Viet Cong terrorists grow crops. In such cases the aim is to eliminate sources of food." On April 4, Jack Wilson of the *Minneapolis Tribune* wrote that "crop spraying has been limited to areas dominated by the Viet Cong" in the central highlands area dominated by the Montagnard tribesmen. Wilson said that "Defense Department officials who receive regular reports on the food spraying campaign feel that the Vietnam government is conducting it with proper regard for its touchy aspects."

The American defoliation program, ostensibly aimed solely at jungle growth, had begun modestly enough in late 1961. In November six C-123 transport planes, normally used for carrying troops, were flown to South Vietnam from Clark Field in the Philippines and outfitted with special tanks and high-pressure nozzles. Each was capable of carrying 10,000 pounds of defoliant, enough to spray more than 300 acres. Only 60 flights were flown that November and December and only 107 flights were made in all of 1962, when the program was still considered experimental. By 1967, however, the defoliation program was at least a 860-million-a-year operation involving 18 of the huge tankers. Early that year Air Force Chief of Staff John P. McConnell told Congress more than one million acres had been sprayed since the program began in 1962, including by Pentagon count, 150,000 acres of cropland out of a total of eight million food-producing acres in all of South Vietnam. As we shall see McConnell's statistics are suspect.

In February, 1968, the Pentagon made public a study on the effects of the defoliation program in Vietnam (to be discussed more fully later) which reported that enough herbicides and other chemicals were used in 1967 to treat 965,000 acres of land. Thus, according to the Pentagon, the total number of acres sprayed in 1967 roughly equaled the acres sprayed during the five previous years. The study added that many areas were treated more than once—and, therefore, the total number of sprayed acres "was significantly less." The report did not specify how many acres of crop-producing land were treated.

The antifood goal of the US defoliation program did not become clear to Americans until late in 1965; perhaps that explains why it escaped critical attention for so many years. By the end of 1966 protests against Chemical and Biological Warfare (CBW) also included the use of anticrop agents. When a group of American scientists presented President Johnson with a petition against CBW in September of that year, they argued that "a dangerous precedent is being set by the current large-scale use of riot gas and anticrop chemicals by U.S. forces in Vietnam."[1]

The use of defoliants to destroy even jungle is, by the military's own definition, an act of chemical warfare. Army Manual TM 3-216, *Military Biology and Biological Agents*, describes the chemicals as possessing "high offensive potential for destroying or for seriously limiting the production of crops and for defoliating vegetation." The manual continues: "There are no proven defensive measures against these compounds. By the time symptoms appear, nothing can be done to prevent damage. The compounds are detoxified in the soil after a period of several weeks to several months."

The United States was aware of its queasy moral position regarding the use of the chemicals. Roger Hilsman, State Department intelligence chief and later Assistant Secretary of State for Far Eastern Affairs during the Kennedy Administration, has written that "the military headquarters in Saigon thought that these defoliants would be ideal for clearing the underbush along the sides of roads where the Viet Cong laid their ambushes and for destroying crops in areas under Viet Cong domination. . . . The State Department view, on the other hand, was that political repercussions would outweigh any possible gains. Defoliation was just too reminiscent of gas warfare. It would cost us international political support, and the Viet Cong would use it to good propaganda advantage as an example of the Americans making war on the peasants."

The State Department, led by Roving Ambassador Averell W. Harriman, bitterly protested a subsequent Pentagon-approved plan to test the chemicals in other Southeast Asian nations. In a manner that was to become habitual, the Pentagon went ahead with a series of highly classified tests, despite the State Department warnings. One such program was known as the Oconus Defoliation Test and involved the aerial application of chemical anticrop agents in Thailand in 1964 and 1965. "Aerial spray treatments were applied at a rate of ½ to 3 gallons per acre on two test sites representing tropical dry evergreen forest and secondary forest and shrub vegetables," one classified test summary reported a year later.

In mid-1967, another Pentagon official told me that three factors led to the decision to use defoliants in Vietnam:

1. The need to conduct defoliation experiments in heavy jungle areas.

2. The needs of the operation military personnel, who viewed defoliation as a means of avoiding or ending ambushes and perhaps starving out the Viet Cong.

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[1] Twenty-two scientists and doctors, including seven Nobel Prize winners, wrote a public letter to Johnson urging him to order an end to the use of chemical agents in Vietnam. The document was then sent to universities and scientists around the nation; by February, 1967, more than 5,000 US scientists, now including 17 Nobel Prize winners and 129 members of the prestigious National Academy of Sciences, had signed. The collection was bound and sent to President Johnson on February 14 after a news conference that put the protest on the front pages of newspapers across the nation.

3. The Chemical Corps promoters who "were always overselling everything." [2]

Adding to the pressure to get on with it was the fact that the defoliation was the first field program of Project Agile, a high-priority Kennedy Administration attempt to speed up research on "counter-insurgency." More than $30 million a year was being spent on the research program by 1965. Designed to provide quick results for ending the war, it had been set up by McNamara in 1962.

Yet by the spring of 1965, the defoliation program for jungle clearing was still unpredictable and Congressmen were wondering just what its value was. "Since we have been in Vietnam," Representative Daniel J. Flood told a general during House Defense Subcommittee appropriation hearings, "we have been experimenting with defoliants . . . we have had all kinds of conflicting opinions and our chemical warfare people have been very unhappy for the last four or five years about the whole program . . . what about this?"

Lieutenant General William W. Dick, Jr., then chief of Army Research, provided a lukewarm endorsement. "Why this was decided to be essential, I do not know, Mr. Flood . . . it is certainly not the answer to all of the problems in Vietnam . . . I have not seen where it failed to defoliate. I have seen reports that it has not solved all the problems in a given area where it has taken the foliage off." A few moments later Dick added that "we still have requirements from the commanders in Vietnam for defoliating agents. They continue to ask for supplies of it. They continue to use it. I can only assume that they find it has an ability to perform a job they want done."

General Dick did not tell the Congressmen that the use of defoliants for clearing brush was, at best, of questionable value. Hilsman noted, after one on-the-spot inspection of a sprayed area during a field trip to Vietnam, that "the leaves were gone but the branches and trunks remained. Even if they had not, it was not leaves and trunks that guerrillas used for cover, but the curves in the road and the hills and valleys. Later, the senior Australian military representative in Saigon, Col. Serong, also pointed out that defoliation actually aided the ambushers—if the vegetation was close to the road those who were ambushed could take cover quickly; when it was removed the guerrillas had a better field of fire."

There is evidence that even during these years of experimentation the chief virtue of the defoliation program was its ability to kill enemy crops, and not its jungle-destroying powers. As early as March, 1963, US officials told Washington newsmen that a Communist campaign then being waged against the use of defoliants in South Vietnam showed that the program was interfering with the food supplies of the Viet Cong guerrillas. They added that the chemicals had been used in areas where the Viet Cong were known to be concentrated. It wasn't until December, 1965, however, that the American public first learned that US planes were deliberately using defoliants and herbicides to destroy rice and other crops in South Vietnam. A *New York Times* dispatch, which said the program "began last spring," reported that up to 75,000 crop-producing acres had been sprayed. "Crop destruction missions are aimed only at relatively small areas of major military importance where the guerrillas grow their own food or where the population is willingly committed to their cause." The dispatch said up to 60 to 90 percent of the crops, once sprayed, were destroyed.

The first official confirmation that the defoliation program was aimed, at least in part, at food-producing areas came in March, 1966, when the State Department announced that about 20,000 acres in South Vietnam, about one-third of 1 percent of the land under cultivation, had been destroyed. The statement was issued as a comment on the case of Robert B. Nichols, an architect who had written President Johnson asking why the United States would attempt to help South Vietnamese grow more food and at the same time attempt to destroy their crops. Nichols had gone on a hunger strike when he received what he considered a less than satisfactory response from the White House. As one critic said later, it took the potential starvation of an American citizen to evoke a clarifying statement from the Johnson Administration about its anticrop program.

A *New York Times* dispatch in July, 1966, noted that the spraying of enemy crops was being stepped up, and added: "The spraying, *begun in 1962* [my italics], has blighted about 130,000 acres of rice and other food plants." Another *Times* story, in September, 1966, quoted Washington officials as saying that there would be no relaxation of the crop-destruction program in South Vietnam despite a series of protests. The dispatch, however, reduced the number of acres treated, quoting Defense Department officials as disclosing that approximately 104,000 acres of food-producing land had been destroyed in South Vietnam, 26,000 less than had been reported ruined six months earlier in a stepped-up program. Also in September, the *Times* reported that the US military, "pleased with the effectiveness of chemical-defoliation and crop-destruction mission," was taking steps to triple the capability of those efforts.

There is evidence that the effectiveness of the defoliation program was still a moot question at that time, although anticrop techniques were highly successful. Early in 1967, Secretary of Defense McNamara told Congress that "defoliation is still a rather primitive technique. . . . It depends for its effectiveness on the time of the year, the type of foliage and on wind and other conditions in the area." What McNamara means was that, despite all the research, it still often took more than a month to strip foliage from trees in South Vietnam. Such problems didn't exist with the anticrop agents, which stimulated plants into frenzied growth and death, sometimes within an hour. Although similar chemicals were used for both missions, the gap in effectiveness between killing a food plant and causing a leaf to fall away had not been solved by mid-1967.

Whether or not the Pentagon initially planned to have its defoliation program lead into an anticrop project really doesn't matter; the facts is that by the end of 1966 more than half of the c-123 missions were admittedly directed at crops, and it is probable that any effort at a trebling of capability in 1967 was aimed not at the jungles of South Vietnam but at its arable crop land.

A 1967 Japanese study of US anticrop and defoliation methods, prepared by Yoichi Fukushima, head of the Agronomy Section of the Japanese Science Council, contradicts the statistics on crop damage issued by the Pentagon. The study claimed that US anticrop attacks have ruined more than 3.8 million acres of arable land in South Vietnam and resulted in the deaths of nearly 1,000 peasants and more than 13,000 livestock. Fukushima said one village was attacked more than thirty times by c-123 crop dusters spraying caustic defoliants and herbicides. The Japanese scientist concluded that "appalling inhumane acts are evident even within the limited admissions officially given out by US Government leaders. . . ." officials have made it plain they considered such claims to be propaganda.

In April, 1966, Joseph Mary Ho Hue Ba, Catholic representative of the National Liberation Front, charged that the US use of defoliants and herbicides was killing newborn babies. The charges were made in a North Vietnamese press agency broadcast monitored in Singapore by Reuters. Its subsequent dispatch quoted the broadcast as contending that hundreds of Catholics had been seriously poisoned by the chemical destruction of crops, which was also causing widespread starvation.

What, exactly, are the chemicals used in Vietnam? Military manuals list five or six potential herbicides, or plant killers, but the Associated Press reported in March, 1967, that three basic types of chemicals are now in use:

Agent Orange, a 50-50 mixture of two comonly used defoliants, 2,4-D (dichlorophenoxyacetic acid) and 2,4,5-T (trichlorophenoxyacetic acid). The mixture is used against heavy jungle and crops.

Agent Blue, a neutralized cacodylic acid sprayed over tall elephant grass and heavier crop concentrations.

Agent White, also known as Tordon 101, a weaker mixture of unknown chemicals used in areas of sizable population.

Many more lethal chemicals may be used in Vietnam, but the Pentagon has not released further data. The other chemicals listed in the manuals are backyard weed killers. When Dr. John Edsall, a Harvard professor, wrote Secretary McNamara early in 1966 to protest the use of anticrop agents, Major General Michael S. Davison, Deputy Assistant Chief of Staff for Force Development, responded. His letter said, in part, "the chemicals used, such as 2,4-D and 2,4,5-T, are those commonly used in agriculture to destroy weeds and other undesirable plants. They harm neither humans nor animals, and do no harm to the soil or water supplies in the concentrations used."

There is much evidence to the contrary. For one thing, cacodylic acid is an organic arsenical acid composed of 54.29 percent arsenic, according to the *Merck Index of Chemicals and Drugs*. Arthur W. Galston, a Yale biologist, has reported that its lethal dose in dogs is one gram per kilogram body weight, administered beneath the skin. "If the same toxicity held for man," Galston wrote in the August-September, 1967, issue of *Science and Citizen*, "then about seventy grams, or slightly over two ounces, would kill the average 150-pound man. . . ."

"The Chemistry and Mode of Action of Herbicides," a study written in 1961 by Alden S. Crafts, a University of California agronomist, notes that "cacodylic acid gives a very rapid top [plant] kill. . . ." Crafts said in a subsequent interview that cacodylic acid would be especially effective against newly sown rice, a main target of the US anticrop attacks; he said 2,4-D and 2,4,5-T have no effect on cereals such as corn, rice, wheat, or barley, but could be used against woody plants. One serious problem with the heavy use of cacodylic acid, Crafts added, is the good chance that it will accidentally spread onto vegetables and fruits in strong enough concentrations to give humans arsenical poisoning.

The cacodylic acid and the phenoxyacetic acids used in Vietnam are described in most reference works as nonselective herbicides,

[2] Oversell apparently is a constant problem with the CBW generals, who are avid boosters of their arsenal. One former Defense official told me he always had problems with the generals when he served in the Pentagon. He explained why: "The Chemical Corps is a cult. Those generals all have Billy Mitchell complexes to infinity. Ideas that the White House or McNamara emphasized when they boosted CBW spending would end up getting perverted by the generals." Billy Mitchell was the Army officer whose campaign for the airplanes led to his court-martial in the 1920s.

i.e., they kill all vegetation present. One study of anticrop chemicals in Vietnam notes that the weed control handbook issued in 1965 by the British Weed Control Council lists 2,4-D and 2,4,5-T as having relatively short persistence in the soil with relatively low levels of toxicity to man and animals. The handbook adds that "prolonged exposure, notably to oil solutions, may cause skin or eye irritation to some individuals. Plastic gloves and light goggles should be available for personnel mixing spray materials. Also, for some types of mist spraying, a face mask is desirable to avoid prolonged breathing in of oil droplets." It further notes that agents must be handled with caution because they "can cause serious damage if spray is allowed to drift onto nearby susceptible crops" or if liquids used for cleaning the spraying equipment are "allowed to flow into running ditches, streams or ponds." The *Merck Index of Chemicals and Drugs* reports further that 2,4-D can cause eye irritation and gastrointestinal upset.

The Air Force's C-123's are designed to distribute their 1,000-gallon, 10,000-pound loads in four minutes over about 300 acres, a rate of roughly more than 3 gallons per acre, the maximum dosage recommended by Army manuals. The program is known as "Operation Ranch Hand." Its lumbering, low-flying planes are said to be the most shot-at in the war. "We are the most hated outfit in Vietnam," *Flying* magazine once quoted Air Force Major Ralph Dresser, head of "Ranch Hand," as saying. The group's slogan is "Only We Can Prevent Forests." A detailed newspaper account of Dresser's crew, the Aerial Spray Flight of the 309th Aerial Commando Squadron, noted that in an emergency the plane's high-pressure spray nozzles can eject the 1,090-gallon cargo in just thirty seconds. Emergencies apparently happen quite often: the newspaper account mentioned that four planes in the squadron took a total of 900 rifle and machine-gun hits during the previous eighteen months of operation. In such cases, the net result could be a huge overdose for the cropland below.

The going rate for a 1,000-gallon cargo of crop-killing chemicals is $5,000; in 1967 the Pentagon announced the purchase of nearly $60 million worth of defoliants and herbicides, enough for 12,000 plane rides over the countryside, each of which would theoretically blanket 300 acres of crop-land. If each mission was successful, 3.6 million acres, nearly half the arable land in South Vietnam, could be covered.[3]

In his letter to Dr. John Edsall, the protesting Harvard biologist, Major General Davison claimed that "great care has been taken to select [anticrop target] areas in which most harm would be done to the Viet Cong and the least harm to the local population. In some instances the local inhabitants, who have been forced to grow food for the Viet Cong, have requested that the herbicides be used. The Government of Vietnam has taken precautions to care for non-combatants whose food supplies have been affected . . . this is not chemical or biological warfare, nor is it a precedent for such. It is in actuality a relatively mild method of putting pressure on a ruthless enemy who has no compunctions about the murder of women and children, as well as men, and about the torture and mutilation of captives."

The Japanese study prepared by Fukushima painted a different picture of the American pressure. The report included testimony from Pham Duc Nam, a peasant and Cao Van Nguyen, a doctor. Pham Duc Nam told of a three-day chemical attack near Da Nang, from February 25 to 27, 1966. He said in part:

"Affected areas covered 120 kilometers east-west and 150 kilometers north-south. Five minutes was all that was needed to wither tapioca, sweet potato . . . and banana plants. Livestock suffered heavy injuries. Unlike men, who could keep clear of chemical-stricken things as food, animals had to eat just anything. Most of the river fish were found lying dead on the surface of mountain streams and brooks. The three days of chemical attack poisoned scores of people, took the lives of about 10 and inflicted a "natus" disease [with symptoms like a severe rash] upon 18,000 inhabitants."

Cao Van Nguyen's testimony included this description of a chemical attack near Saigon on October 3, 1964:

"A vast expanse of woods, approximately 1,000 hectares [nearly 2,500 acres] of crop-producing land, and more than 1,000 inhabitants were affected. A large number of livestock were also poisoned and some of them died. The majority of the poisoned people did not take any food from these crops, nor drink any of the water that had been covered or mixed with the sprinkled farm chemicals. They had only breathed in the polluted air or the poison had touched their skin. At first, they felt sick and had some diarrhea; then they began to feel it hard to breathe and they had low blood pressure; some serious cases had trouble with their optic nerves and went blind. Pregnant women gave birth to still-born or premature children. Most of the affected cattle died from serious diarrhea, and river fish floated on the surface of the water belly up, soon after the chemicals were spread."

No American reporter or witness has told of similar consequences from an anticrop attack,[4] but an American attached to the United States Operations Mission (USOM) agricultural team in the Bien Hoa area just northeast of Saigon issued a bitter private report to his superiors in April, 1965, noting that:

"I have repeatedly complained of the reckless use of defoliants in the Bien Hoa area. Last season drift over considerable areas of water spinach caused misshapen unmarketable stems. These stems were fed to pigs and several pigs were reported to have died . . . other plants were damaged. The peasants report it is affecting the health of the children . . . in Bien Hoa the military is engendering needless bitterness among the peasants and the government further loses the good will and support they rather desperately need. It seems to me this matter should be brought to the attention of the military liaison officer. . . ."

His complaints prompted USOM officials from Saigon and military advisers to inspect the Bien Hoa area. The visitors were optimistic in their May 4 report to Saigon, and their chief tended to downplay the report of heavy damage:

"The agricultural agents said that 500 complaints or requests for damages had been filed with hamlet chiefs for transmission to the province chief . . . I suspect this number is an inaccurate exaggeration and that of those claims actually submitted many were for damages not associated with defoliants."

The inspection team recommended that the farmers be educated "to enable them to identify damage due to defoliants and avoid confusing it with other troubles." The report concluded:

"If a continued coordinated effort is made by all parties it should be possible to assess the damage and settle the few legitimate claims in a fair manner. Thus there should be no grounds for a hostile reaction of the farmers toward the government."

The Saigon official also had a suggestion for the area around III Corps Headquarters in Bien Hoa, which had been heavily sprayed to prevent ambushes—with a considerable loss of trees and banana crops. "Since I assume that the area should remain clear for an indefinite period, the use of chemicals for soil application only may be worth considering," his report said. "These would have a more lasting effect and drift should not be a problem if hand sprayers are used." Soil sterilization has not been an announced part of the US defoliation program.[5]

According to newspaper reports, the defoliation missions are scheduled through what one called "a ticklish diplomatic business." Nominations of potential targets are made by either US or South Vietnamese Army commanders who then check with the province chief. The recommendation then goes to the Vietnamese Army's Headquarters in Saigon and, if approved, to the Intelligence Section of US Headquarters. From there, it must go to the US Embassy for final approval by the Ambassador. The setup is apparently only *pro forma*. Former officials have admitted that the system was quickly corrupted by both the Americans and the Vietnamese.

In September, 1966, *The New York Times* quoted some "American officials" as conceding that "occasionally some spray may drift from a target area, causing damage to rice crops or rubber trees. When claims are made, prompt action is taken to pay damages. . . . The current price for a mature rubber tree is $87." Other available USOM field reports, this time from the fertile Can Tho area of the Mekong Delta, indicate that accidental spraying occurs more than occasionally. One report noted that on December 13, 1965, three aircraft flew over Thoi An Dong village in nearby Phong Phu district "spraying defoliant extensively. As a result, maturing watermelons, rice, vegetables and fruits . . . were all damaged, thus inflicting serious losses to the farmers . . . Thoi An Dong village of Phong Phu district is located in a rather

[3] The heavy military purchases of commercial defoliants have vastly outstripped existing production capacity in the United States and a shortage of the chemicals is anticipated, *Business Week* magazine reported in April, 1967. The magazine said some industry sources believe the military demand for 2,4,5-T to be four times production capacity. In 1965 the chemical industry produced nearly seventy-seven million pounds of 2,4,5-T and 2,4-D. *Business Week* said the commercial shortage would hit ranchers, farmers, and utilities the hardest; it added that the Business and Defense Services Administration has been ordered to assure that military orders will be met in full.

[4] Reuters reported from Saigon early in 1967, however, that "Chemical sprays have played havoc with bird life, destroying vegetation and the insects on which birds feed. Monkey and deer have also been affected." No American news agency has said as much. The military seems to have developed an excellent gambit to combat such stories: both the *Christian Science Monitor* and *Flying* magazine have filed approving dispatches on the defoliation program telling how, at one point, an officer being interviewed suddenly reached out and dabbed some of the chemical on his tongue. The officer's point seems to be that the chemicals are not harmful to human life.

[5] Still, sterilization plays a big role in US planning. The anti-infiltration barrier between North and South Vietnam, announced by Defense Secretary McNamara on September 8, 1967, calls for the use of soil killers. "The soil poisoners are required," the Associated Press explained the next day, "because military commanders have found that thriving vegetation starts growing back almost as quickly as bulldozers clear a strip" in the Demilitarized Zone. Some soil killers, such as sodium arsenate, can leave the ground arid for up to ten years. When the American scientists presented their anti-CBW petition to the White House early in 1967, the Pentagon said there were no plans to use soil sterilants.

secure area but, according to the leaflet as dropped by the Government authority 24 hours before spraying this village was unbelievably categorized as an area supplying food to the Viet Cong, thus shaking the faith of the rural people in the measures taken by the Government."

Two similar "accidental" sprayings of other hamlets were cited.

A field report dated January, 1966, also noted that crop damage due to the spraying ranged from 40 to 100 percent, "rendering the farmers unable to harvest their crops for profitable marketing during the lunar New Year season as otherwise expected. . . . The total area devastated by defoliation is believed to be much wider than those villages as mentioned, as the assumption is that quite a few farmers have not filed complaints with the local Government offices."

The field reports noted caustically that farmers were not getting their money because the reimbursements involved a seven-step process simply to get the damages certified by the Central Government and approved for local action by the province chiefs. The process broke down even further there, the report said, because many of the unscrupulous province chiefs were pocketing the damage payments.

When a Yale University biologist protested to President Johnson in September, 1966, about possible injury to civilians resulting from the attacks with anticrop chemicals, he received a reply from Dixon Donnelly, Assistant Secretary of State for Public Affairs, assuring him that "civilians or noncombatants are warned of such action in advance. They are asked to leave the area and are provided food and good treatment by the Government of Vietnam in their resettlement area."

The government's request to the peasants comes in the form of pamphlets that are rained down on the target area from airplanes. One such pamphlet reads as follows:

"The Government of the Republic of Vietnam has adopted the use of defoliants which will ruin your rice crop and other crop plants in the field. This has been necessary as your rice fields are located in areas supplying food to the Viet Cong. However, you should not be disappointed as the Government will compensate for all the damage done to your rice crop. Meanwhile the Government will at all times help evacuate you to other places with food, lodging and clothing provided until the next harvesting season, if you so desire."

In an excellent discussion of this sort of warfare in the June 29, 1966, issue of Christian Century two Harvard physicians, Dr. Jean Mayer, Professor of Nutrition, and Dr. Victor W. Sidel, noted that the stated aim of the U.S. program is to starve the Viet Cong by destroying its food rations:

In essence, this aim is similar to that of every food blockade (such as the one imposed against the Central Powers in World War I). As a nutritionist who has seen famines on three continents, one of them Asia, and as a physician with a basic interest in preventive medicine, we can say flatly that there has never been a famine or a food shortage—whatever might have been its cause—which has not first and overwhelmingly affected the small children.

The process, the authors said, begins with the death from starvation of small children first, then older children, and then the elderly. Adolescents are likely to survive and adult men are far less affected. "Thus the bands of armed men who make up the Viet Cong are not likely to starve; being unhampered by family ties with people in the communities where they rove, they feel entirely justified in seizing any available food in order to have the strength to continue to fight." The point is "not that innocent bystanders will be hurt by such measures but that only innocent bystanders will be hurt."

The use of chemicals in unprecedented dosage also threatens the natural balance of the land itself, with devastating long-range results. Many scientists have argued that the defoliants and herbicides, besides causing immediate harm to the people and property in the sprayed area, will trigger changes in ecology that may permanently reduce once-fertile crop fields to dust bowls. The Pentagon, in an effort to counter this kind of criticism, released in February, 1968, a 369-page Advanced Research Projects Agency (ARPA) report entitled "Assessment of Ecological Effects of Extensive or Repeated Use of Herbicides." The report, prepared by the Midwest Research Institute of Kansas City, Missouri, optimistically concluded that there was no clear evidence that the chemical anticrop program would cause permanent damage to treated areas in South Vietnam. The report also concluded that the possibility of lethal toxicity to humans or animals by use of the herbicides "is highly unlikely and should not be a matter of deep concern." Similarly, the assessment said it "is impossible" to draw any conclusions about the effect of the chemicals on water quality in South Vietnam.[6]

The four-and-one-half-month study had some glaring loopholes. For one thing, critics noted, the report had been prepared solely on the basis of interviews and the researching of scientific literature. No on-the-spot investigations or field trips were made by personnel from the Kansas City research firm. The firm's final report noted early in the text that "the long-term ecological effects of the use of herbicides are difficult to predict." At a later point, the study said that "The use of herbicides in the Southeast Asia theatre represents the most widespread application of herbicides that has ever been undertaken in a brief time interval." The report also noted a lack of information concerning cacodylic acid, and suggested further investigation into its effect "would be advisable . . . before [its] use in a single area is continued for a prolonged period of time." The net result of the Pentagon report was, as one science writer said, "to leave up in the air the seriousness of effects from U.S. defoliation activities." There was nothing in the Pentagon study to seriously challenge Arthur W. Galston's conclusion in *Science and Citizen* that—

"We are ignorant of the interplay of forces in ecological problems to know how far-reaching and how lasting will be the changes in ecology brought about by the wide-spread spraying of herbicides in Vietnam. These changes may include immediate harm to people in the sprayed areas and may extend to serious and lasting damage to soil and agriculture, rendering more difficult South Vietnam's recovery from war, regardless of who is the 'victor.'"

Along with the chemical anticrop program, the United States and South Vietnamese troops have made it a deliberate policy to mutilate arable land suspected of being under Viet Cong control. Often Vietnamese farm laborers are taken from the fields and placed in refugee camps, leaving harvests to rot. Thousands of tons of harvested rice found in Viet Cong-dominated areas have been dumped into rivers, burned, scattered, smeared with repellent, etc. The military also has put into use a device known as the Rome plow, a sharpened 2,500-pound bulldozer blade that has been commercially used in the United States for ground-clearing operations. Army engineers have stripped hundreds of thousands of acres of jungle and brush in an attempt to locate Viet Cong food storage areas and prevent ambushes.

In some cases, herbicides are applied in cleared areas to prevent future growth. Between July 1 and December 3, 1967, according to *The New York Times*, Army crews in the III Corps (north-central) area of South Vietnam cleared 102,000 acres of all plant life. One plow is capable of clearing about 2,700 yards of trees, shrubs, etc., per hour. As a consequence of this and similar operations, South Vietnam, which exported forty-nine million metric tons of rice in 1964, may have to receive as much as 800,000 metric tons of US-supplied rice in 1968, according to a Department of Agriculture estimate.

A report on medical problems in South Vietnam, in January, 1967, by the Boston-based Physicians for Social Responsibility, noted that malnutrition, even before the use of anticrop chemicals, was a serious problem in the nation, with the average Vietnamese consuming about 20 percent of the food eaten daily by a North American. "Beriberi and night blindness are leading nutritional diseases among patients in many hospitals," the report said. "Anemia is widespread and there is a high incidence of infectious and inflaminatory diseases of the mouth . . . one American physician observed that teeth are poor in all age groups and both baby and permanent teeth rot quickly. Endemic goiter is found in many parts of the country."

Military men maintain that the use of defoliants serves two functions: taking the enemy's food and conserving manpower. "What's the difference between denying the Viet Cong rice by destroying it from the air or by sending in large numbers of ground forces to prevent the enemy from getting it?" *The New York Times* quotes one officer as asking in 1966. "The end result's the same; only the first method takes far less men."

But by early 1967 Presidential advisers had a different reason for using herbicides, one that wasn't directly linked to cutting off Viet Cong food supplies. The rationale was presented to a group of scientists who met in February with Donald Hornig, President Johnson's chief scientific adviser, to protest the use of anticrop chemicals. According to one scientist who attended the session, Hornig explained that the anticrop program was aimed chiefly at moving the people. The source quoted Hornig as explaining that when the United States found a Viet Cong-supporting area, it was faced with the alternatives of either bombing, bulldozing, and attacking it or dropping leaflets telling the people to move because the herbicides were coming. As Hornig expressed it, "it's all geared to moving people."

[6] The study did caution, however, that the use of chemical anticrop agents may result in the conversion of the rich jungle soil in South Vietnam into rocky laterite, which is useless for agriculture. The process of conversion, known as laterization, occurs in tropical regions when the organic material and chemicals that normally enrich the soil are washed away because of lack of protective growth. The result is a reddish soil which bakes to a brick-like consistency upon exposure to sunlight. The process has begun in some areas of Vietnam where villages once existed, the study noted. The villagers cleared the jungle, cultivated the land, and exhausted its fertile soil before moving on. The Kansas City study stated: "We are not aware of any instance where this final and irreversible stage of the laterization process has occurred because of its acceleration by herbicidal destruction of vegetation." It warned, however, that "Although no related evidence for irreversible changes . . . exists, it is a point that deserves further consideration."

[From the New York Review of Books, May 9, 1968]

POISON GAS IN VIETNAM

(By Seymour M. Hersh)

Sometime early in 1964 the Pentagon asked the State Department to investigate and prepare a memo on the legality of the use of non-lethal gases in South Vietnam. The Pentagon's point of view already was known: Army Field Manual 27-10, *Law of Land Warfare*, says "the United States is not a party to any treaty now in force, that prohibits or restricts the use in warfare of toxic or non-toxic gases, or smoke or incendiary materials, or of bacteriological warfare."

The State Department has traditionally been skeptical about the use of CBW agents; the United States had been one of the principals of the 1925 Geneva Conference which outlawed the use of asphyxiating, poisonous, or other gases.[1] Nevertheless, the State Department eventually sent the Defense Department a memo agreeing that the non-lethal agents were legal. The State Department memo, however, contained a long list of stringent limitations on such use.

"State made a mistake," an official familiar with the situation told me three years later, "by saying it was okay—with limitations." So far as the men in the Pentagon were concerned, "It was either yes or no: they [the State Department] were just kidding themselves with the restrictions." The lesson of all this, the official said, "is that when the crunch comes, the Pentagon sets the requirements and State finds the reasons why it's legal."

The United States apparently began equipping the South Vietnamese Army with two of its three standard riot control, or non-lethal gases in 1962 under the existing Military Assistance Program (MAP). The agents were CN, the standard tear gas used to quell civil disorders, and CS, the newly developed super tear gas. The third riot control agent, DM (adamsite), a nausea-producing gas, apparently did not reach Vietnam until 1964.

The military's riot control gases are described by Army field manuals as agents that "produce temporary irritating or disabling physiological effects when in contact with the eyes or when inhaled. Riot control agents used in field concentration do not permanently injure personnel." The gases are actually solids that are disseminated as aerosols via grenades. Modern military chemical research has made little contribution to this aspect of the war arsenal; both CN and DM were invented in the latter days of World War I, and CS was reportedly developed by the British in the 1950s and adapted for United States use.

CN's chemical name is chloroacetrophenone and its formula usually is given as $C_6H_5COCCH_2Cl$. It has a deceptive, fragrant odor similar to that of apple blossoms. The gas is a fast-acting tear agent that is also an irritant to the upper respiratory passages. An Army manual, *Military Chemistry and Chemical Agents* (TM 3-215), makes these further points:

"In higher concentrations it is irritating to the skin and causes a burning and itching sensation, especially on moist parts of the body. High concentrations can cause blisters. The effects are similar to those of sunburn, are entirely harmless and disappear in a few hours. Certain individuals experience nausea following exposure to CN."

CS (the s stands for super) is chemically known as o-chlorobenzalmalononitrile. Its formula is $ClC_6H_4CHC(CN_2)$. TM 3-215 lists the following physiological effects:

"CS produces immediate effects even in low concentrations. . . . The onset for incapacitation is 20 to 60 seconds and the duration of effects is 5 to 10 minutes after the affected individual is removed to fresh air. During this time the affected individuals are incapable of effective concerted action. The physiological effects include extreme burning of the eyes accompanied by copious flow of tears, coughing, difficulty in breathing, and chest tightness, involuntary closing of the eyes, stinging sensations of moist skin, running nose, and dizziness or swimming of the head. Heavy concentrations will cause nausea and vomiting in addition to the above effects."

DM, or adamsite, initially developed by the Germans in World War I, is the most toxic of the riot control agents. Its chemical name is diphenylaminochloroarsine and its formula is $NH(C_6H_4)_2$ ASCl. The AS in the formula is arsenic. The pepper-like gas causes these symptoms in progressive order, according to TM 3-215: "Irritation of the eyes and mucous membranes, viscous discharge from the nose similar to that caused by a cold, sneezing and coughing, severe headache, acute pain and tightness in the chest and nausea and vomiting. . . . At higher concentrations, the effects may last up to three hours."

Army Field Manual 3-10, *Employment of Chemical and Biological Agents*, lists DM, CS and CN together as riot control agents, a somewhat misleading category. In *Chemicals in War*, a history of gas warfare written in 1937 by Brigadier General Augustin M. Prentiss of the Chemical Warfare Service, CN is listed as a simple tear gas agent and DM is listed separately as a respiratory irritant. Prentiss had this to say about DM's toxicity:

"One is not aware of breathing this gas until sufficient has been absorbed to produce its typical physiological effects. It irritates the nose and throat in concentrations as low as .00038 milligrams per liter and causes irritation of the lower respiratory tract at a concentration of .0005 mg. per liter. A concentration of .65 mg. per liter is lethal at 30 minutes' exposure while the lethal concentration for 10 minutes is 3 mg. per liter."

Put another way, Prentiss's statistics mean that DM is lethal upon 10 minutes' exposure to the gas in concentrations of 1/10,000 of an ounce per quart of air.

The Army has been combining DM and CN in a grenade for use in Vietnam. "Since DM requires several minutes to produce maximum effects, it may be combined with CN to produce effects more rapidly," explains FM 3-10. The manual adds this word of caution:

"DM alone is not approved for use in riot control dispersers in any operations where deaths are not acceptable. Excessive, and possibly lethal, or completely incapacitating dosages can be developed from its use. However, it may be used in military or paramilitary operations, on counterinsurgency operations, or in limited or general war where control of target personnel by the incapacitating effects is desired and where possible deaths are acceptable."

The South Vietnamese, acting on their own initiative, used CS and CN to break up a Buddhist riot in Saigon on November 2, 1964. By the next month the South Vietnamese Army, guided by US advisers, initiated the use of DM, CS, and CN in military operations against the Viet Cong. In missions carried out in strictest secrecy, the munitions were used on December 23 in Xuyen province, on December 25 in Tay Ninh province near Saigon, and on January 28, 1965, in Phu Yen province.

On March 22, 1965, Horst Faas, an Associated Press reporter tagging along on a combat mission near Saigon, learned that the operation plans called for the use of DM if the government forces were pinned down by the Viet Cong. He was told that the agent caused vomiting and diarrhea. No enemy contact was made during the mission and Faas returned to Saigon to report what he had heard and seen. The news service carried on its teletypes the next day a story revealing that the United States was "experimenting" with gas warfare. This was subsequently confirmed in Washington and Saigon.

What Faas saw set off a worldwide protest that apparently caught US policymakers by surprise. The White House, State Department, and Pentagon each responded to the controversy by arguing, in effect, that there was nothing unusual in the use of riot control gases. But US officials took unusually elaborate steps that March 23 to get their point across the press and public. McNamara quickly summoned Pentagon newsmen to his office, described the three gases in detail, and made it clear that the United States had no intention of stopping their use against Viet Cong guerrillas. He emphasized that the gases were similar to those used by police forces around the world to curb civil disturbances, and listed a number of such uses. McNamara did not mention that adamsite is rarely used by police anywhere.

Secretary of State Dean Rusk made an unusual appearance at the regular daily noon briefing at the State Department to deny that the United States was embarking on the use of gas warfare in Vietnam. "We are not talking about agents or weapons that are associated with gas warfare, the military arsenals of many countries [sic]," he told the reporters. "We are not talking about gas that is prohibited by the Geneva Convention of 1925, or any other understanding about the use of gas."

Rusk, too, emphasized that the agents used were gases available commercially, and said it was anticipated that "these weapons be used only in those situations involving riot control or situations analogous to riot control." He admitted that the United States may have committed a major propaganda blooper, not by using the gases, but by attempting to hold back public knowledge of the new step. "It may be that there was a failure in full explanation, in briefing or reporting from Saigon on this matter," Rusk allowed, adding that the initial AP story tended to stimulate problems "which were not present—for example the use of the word 'experimentation' suggested that something new and weird might be involved here. That is not the case."

At the White House, Press Secretary George Reedy went to elaborate steps to disassociate President Johnson from the use of nausea gas. He said the President had not been consulted about its use and described adamsite as a "rather standard-type riot-control agent." Reedy said full responsibility for its use depended on General William C. Westmoreland, commander of the US forces in Saigon.

The American use of gas was condemned throughout the world: a Frankfurt newspaper published a cartoon showing the Statue of Liberty wearing a gas mask; *Mainichi Shimbun*, one of Japan's largest newspapers, carried a cartoon of Adolf Hitler's ghost hovering over Vietnam with a bag labeled "Vietnam" in his right hand. In New York, the *Times*, in a sharply critical editorial, pointed

[1] The US delegation signed the treaty but the Senate Foreign Relations Committee refused to ratify it in 1926 after a rare closed-door debate. Thirty-two nations eventually adhered to the Protocol which was violated only once before 1964, when Italy used mustard gas against Ethiopia in the Abyssinian Campaign of 1936. The United States has consistently expressed its support of the 1925 agreement, and has publicly acknowledged it considers itself bound in full by it. Moreover, the US and ninety-five other nations voted during a little-noticed UN General Assembly meeting in December, 1066, to reaffirm the principles of the Geneva Protocol. Most international lawyers argue that the United States, whether it agreed or not is bound by the Protocol simply because it has acted as if it had signed the agreement; this opinion is held by many in the State Department.

out that "in Vietnam, gas was supplied and sanctioned by white men against Asians. This is something that no Asian, Communist or not, will forget. No other country has employed such a weapon in recent warfare."

The Soviet Union took the issue to the United Nations, where it accused the United States of grossly violating "the accepted rules of international law and of the elementary principles of morality and humanity. The US Government is, of course, aware that the use of asphyxiating, poisonous or other gases has long since been prohibited and vigorously condemned by the peoples of the world." Similar Soviet charges were made in a note delivered to the US Embassy in Moscow. The United States replied, in a letter to the President of the UN Security Council, that the Soviet note had been rejected because it "was based on the completely false allegation that poisonous gases are being used in South Vietnam. . . ." The US note went on to describe the chemicals used in Vietnam as non-toxic and not prohibited by the 1925 Geneva Protocol as interpreted by the United States.

By this time, even the United States Information Agency had protested to the White House that the use of gas in Vietnam was resulting in a substantial loss of international prestige. But the Johnson Administration was determined not to back down. Asked about the issue at a press conference on April 2, the President criticized the initial AP dispatch which he said implied that "we were using poisonous gas—mustard gas or a war gas—to kill people. And it took the government two weeks to catch up with that story. . . ." The President then described the gases as products that could be purchased "by any individual from open stocks in this country just like you order something out of a Sears and Roebuck catalogue." He added that he had known nothing about the gas. "No one told me that the South Vietnamese Army were going to use any tear gas any more than they told me they were going to shoot that fellow that dropped the bomb, left the bomb in his car in front of our Embassy, but there's no reason why they should." (He was referring to a recent terrorist bombing of the US Embassy in Saigon.) "I just wish," the President concluded, "there was concern with our soldiers who are dying as they are [*sic*] with somebody's eyes who watered a little bit. . . ."

Thus, within two weeks of the initial press reports, all top-ranking US officials had faced press conferences at which they appeared surprised and almost baffled by the heated protests over the use of riot control agents. The substance of the official statements was that the United States did not accept any distinctions between tear gas and nausea gas, and that this country was not violating the Geneva Convention, a treaty it had not signed, by using such gases.

In fact, there is considerable evidence that American officials were well aware of the perils of the use of tear and other gases—from the White House down through other executive offices. The decision to approve the use of gas was apparently made on the highest levels of the Administration. A White House adviser told me in August, 1967, that the decision taken in 1964 had been a difficult one. "This was a problem," he acknowledged. "We're not overjoyed with the use of tear gas, but people have decided it represented a humane decision." He added: "When all of the factors were weighed, we decided to use it."

During a State Department briefing March 23, 1965, press officer Robert McCloskey was asked if State had given its approval for the use of gas in Vietnam. "Oh, I think I said pretty clearly," McCloskey answered, "that this was supplied by the U.S. Government and that would imply concurrence by all agencies and departments thereof." He added that the State Department had been specifically informed that the gases had been supplied to the Vietnamese but did not know whether our high officials had been warned before the gas was used.

The intense secrecy surrounding the initial use of tear and nausea gases in Vietnam can be viewed, therefore, as an outgrowth of the many meetings, memos, and discussions that went into the initial 1964 decision to use the new weapons. Some program had apparently been prepared to advise the American public gradually of the new element in the Vietnam war, but it was not used.

The result of the March, 1965 controversy was a slowing down in the promulgation of gas warfare in South Vietnam, although the Johnson Administration had carefully built a rationale for such use. Gases were not used during the next six months. In the interim, *The New York Times* reported that field commanders in Vietnam had been ordered to make no further use of any type of gas—the story was attributed to "informed sources in Washington." The newspaper later quoted an unnamed American official as saying, apparently while on an inspection trip to Saigon, that he would rather "lose the war" than authorize the field use of gas.

When gas warfare was again used in Vietnam, it was accompanied by a careful public relations program. On September 7, the US military command in Saigon announced that a Marine Battalion Commander, Lieutenant Colonel L. N. Utter, had been placed under investigation because he had authorized the use of eighteen canisters of tear gas during a small US field operation against the Viet Cong the week before. According to *The New York Times* version of the incident, "Colonel Utter was reported to have felt that tear gas was the most humane way to dislodge the Viet Cong suspects, who were using the women and children as a shield." The article noted that Utter "decided against using fragmentation grenades, flame throwers or automatic weapons."

U.S. officials told reporters that the colonel had acknowledged full responsibility for the use of the gas. The investigation was chiefly to determine whether Utter was aware of the reported ban on the use of gas: at the time, only General William C. Westmoreland had the authority to order the use of gas. Saigon officials told reporters that if Utter had asked Westmoreland for permission, "his request would have been denied." When a reporter asked why the Marines were still being issued tear gas, he was told that it was part of the "basic equipment" of all units and was needed for riot control and self-protection.

Utter's use of tear gas brought no significant public outcry, apparently because it was accompanied by a promised investigation. Some two weeks later, on September 22, Westmoreland asked the Pentagon for permission to use tear gas in cases in which, he said, its application would be more humane than conventional weapons. A front-page story in *The New York Times* noted that Westmoreland technically has such authority. "However," *The Times* added, "it is known that high Administration officials have pledged not to use such gases again except perhaps in ordinary riot situations."

At the same time, both United Press International and Associated Press sent almost identical news stories reporting that Westmoreland had asked Washington to "lift," "relax," or "re-examine" the ban. In response to these stories, the Pentagon announced that the United States had never foreclosed its right to use non-lethal gases. The Pentagon said:

"As previously stated, the commander of the United States military command in Vietnam has the authority to use tear gas under appropriate circumstances. The use of riot control agents has always been and still is considered to be left to the commander, under appropriate circumstances."

The public clearly was being cautiously readied for more frequent use of non-lethal tear gases. None of the September statements mentioned adamsite, the nausea gas that had provoked much of the criticism in March. One reporter commented later on the Utter incident that "officials now, as opposed to last winter, are quite willing to notice a distinction between tear gas and vomiting gas and are indicating that vomiting gas is unlikely to be used in the future . . . that officials now are conceding a distinction does not indicate they have just gotten around to noticing it; it merely means they now find it useful to publicly notice it."

On September 25, Westmoreland announced that no disciplinary action would be taken against Lieutenant Colonel Utter, and refused to say anything more about the case. US spokesmen, who earlier had told reporters that the investigation would attempt to determine whether Utter had known of the tear gas ban, also refused to reveal the results of the investigation.

The Utter case was apparently a sham, a carefully planned trial balloon designed to make tear gas operational once again in Vietnam without public outcry. In October, 1965, researchers for Travelers Research Center in Hartford, Connecticut, a subsidiary of the insurance company, completed a private study for the Pentagon of "US Governmental Policies on Chemical and Biological Weapons and Warfare." The unclassified document, known as "Project Puissance," quoted one source as saying that "neither the Pentagon nor the military in Saigon ever, repeat, ever issued orders that tear gas should not be used. A brisk correspondence between Marine Corps top brass and General Westmoreland has established beyond a shadow of a doubt that there was no such order." The study also said that General Wallace M. Greene, Commandant of the Marine Corps, confirmed in a private letter that "there never has been, nor is there now, any intention to court martial or take any other disciplinary action against Lieutenant Colonel Utter. The decisions he made was fully justified."

The Pentagon's handling of the tear gas incident won praise in the October 11, 1965, issue of the *Washington Daily News*. "Little if any public protest is being voiced over renewed use of tear gas and other non-lethal gases by US troops in Vietnam," the paper said in its lead editorial. "There is a lesson to be learned from the contrast between this quiet acceptance and the loud outcry which arose last March when it was first revealed the gases were being employed. At that time, public opinion here and abroad was totally unprepared." "Public opinion is often wrong, sometimes foolishly so," the editorial concluded. "But the US still has a lot to learn about what it is and how to make it work for us."

The Pentagon remained cautious. A month after the Utter incident, it used gas in a joint operation with Australian troops near Saigon. A major effort was made to soothe public opinion. A full twenty-four hours before the battle, officials advised a number of correspondents that gas would be used and bound them to stringent secrecy. According to a *Washington Post* dispatch on October 8, troops of the 173rd Airborne Brigade were rigidly drilled to speak of "tear gas" and not just "gas," in case reporters asked them questions.

As the operation was getting under way, Brigadier General Ellis Williamson, then Commander of the 173rd, assembled reporters and read out this portion of his orders for the morning:

"Tear gas may be used on this operation if the local unit commander feels that its employment will assist in accomplishing the

operation requirement with fewer casualties to friend and foe. It is anticipated that the use of tear gas will be restricted to small areas where the enemy is holed up in bunkers or trenches."

The *Chicago Daily News* described the operation as a test of a new "departure in US policy in the laboratory of world opinion. [The soldiers] were armed with tear gas and they specifically were authorized to use it."

The reaction to the dispatches was positive, from the military point of view. *Navy* magazine reprinted an editorial in its October, 1965, issue which noted that "the reaction in the US press this time has been heavily favorable, indicating that there is now a much better understanding, at least among American editors, of the humaneness of gas compared to the deadly effects of napalm, automatic weapons fire and flame throwers."

The *Times* reported on October 6 that Westmoreland had received official permission to use tear gas in military operations when it would save lives: "there was no official confirmation of the permission from Washington because the Administration has taken the position that General Westmoreland never lost his authority to use tear gas." The *Times* report added that technically this was true, but in practice Westmoreland had been told not to use his authority without permission from the Administration. If President Johnson and other officials had been outflanked by Westmoreland during the Utter incident, Washington clearly had approved the well co-ordinated October tear gas attack by the 173rd Brigade.

Subsequently, the use of tear gas became more common in South Vietnam, although the gases were initially confined to tunnels in accordance with the official decision to permit their use in military operations only if it would save lives. In early 1966, the Army said it was using riot control agents in Vietnam "quite routinely and with great success." Military spokesmen made clear that discretion for such use was again left in the hands of the military commanders in the field.

On February 21, 1966, however, the Administration significantly changed the role of gases in Vietnam. Helicopters dropped hundreds of tear gas grenades on a small patch of jungle 265 miles northeast of Saigon, which was believed to be a Viet Cong stronghold. Shortly thereafter, huge B–52 bombers rolled over the jungle area and saturated about 85 percent of the jungle patch with bombs. According to official estimates, 400 guerrillas were trapped in the tiny area whose widest point was only about 400 yards. After the bombing raids, two battalions of airmobile troops, equipped with gas masks, were shuttled in to search for the enemy. *The New York Times* quoted Washington officials as explaining that the new tactic of the helicopter-borne tear gas attack "was designed to flush Viet Cong troops out of bunkers and tunnels before the attack by B–52 bombers." It was further explained that past B–52 bombing missions had done little or no damage to Viet Cong troops who were usually well-protected in tunnels or bunkers. "The purpose of the gas attack," *The Times* said, "was to force the Viet Cong troops to the surface where they would be vulnerable to the fragmentation effects of the bomb bursts."

It was this projected use of the non-lethal gases, apparently, that had led the Administration to rally so vigorously to the defense of gas warfare the previous March. Thorough newspaper accounts of the February attack brought little renewed criticism of the use of gases, a factor that apparently led the Administration to move into yet another phase.

On May 8, US planes dropped twelve tons of CS gas in a jungle near the Cambodian border, "to pave the way," according to United Press International, "for a ground assault by gas-masked US infantrymen." Other dispatches about the attacks indicated that nausea-producing DM had been used, but the Pentagon denied such reports and said they stemmed from the fact that the CS had been used in such heavy concentrations that it caused nausea. The UPI story described the attack as resulting in "one of the largest doses of gas Americans ever have spread over enemy territory."

Similar operations were carried out during the rest of 1966, although news accounts became more and more sketchy as the use of gases became more and more acceptable and, hence, less of a story.

The lack of further protest may have prompted the Administration again to escalate the gas war. In August, 1967, officials announced that nausea gas had been used in South Vietnam; there were no world-wide protests this time. Four paragraphs distributed by UPI were printed on page nine of the August 18 *Washington Post;* the incident took up one paragraph in an Associated Press dispatch the next afternoon. According to UPI, the nausea gas was used on a suspected North Vietnamese stronghold south of the Demilitarized Zone in the hope that it would flush out Communist troops, but none appeared. "US forces previously have used tear gas and nausea gas to drive Viet Cong guerrillas out of tunnels and bunkers," the UPI report continued, "but today's action marked the first extensive use of the gas above ground in several months." It also marked the first time the US military command in Vietnam had acknowledged nausea gases were again in use, although the January 31, 1966 issue of *U.S. News and World Report* acknowledged that DM had "been experimented with in Vietnam warfare in recent weeks." The gas was used in canisters along with CN.[2]

By September, 1967, the CBW promoters were back at work. Ray Cromley, a columnist for the Newspaper Enterprise Association and an Army Reserve Colonel, wrote a column praising the use of tear gas for saving lives in South Vietnam; he concluded:

"But there is a sad note to this story. V.C. tunnels frequently are so long and have so many curves and exits that the tear gas isn't effective . . . Other non-lethal gases are available—gases, for example, which make people laugh and not care what's going on. Some of these might be more suitable for Vietnam's tunnels. Thus far, the men who make the decisions have been afraid to use these other gases for fear of a renewed worldwide outcry."

What Cromley did not write is that the striking similarity of all the gas attacks between December, 1964 and August, 1967 is their military failure. None of the attacks met its objective to any degree.

The first attacks in 1964, the London *Observer* reported, were aimed at rescuing a group of American prisoners held by the Viet Cong in the Mekong Delta. In both instances, helicopters spread a cloud of gas over the targets. "The two attempts were futile. Both times the ground troops found no Viet Cong although there was evidence they had been there. If any prisonere had been held in those sites, the Viet Cong had led them away before the troops reached the area." An AP dispatch later told of one 1964 mission in which American helicopters laid down a gas cloud and South Vietnamese troops quickly moved into the area. Some firing came from the gassed area and, AP said, "the Vietnamese forces fled in disorder."

The carefully publicized use of gas on October 8, 1965, by the 173rd Airborne Brigade was also a flop. US troops dropped a grenade down a cave in a jungle area believed held by the Viet Cong. "As it turned out," *The New York Times* reported the next day, "there was apparently nobody in the cave in which the tear gas grenade was buried."

The AP produced a detailed account of the failure of a gas mission in January, 1967, aimed at flushing Viet Cong out of a vast tunnel complex about twenty-five miles northwest of Saigon. "The most recent attempt to use riot control gas on a major objective in the Vietnam war apparently has failed like most of the others," the AP story said. No Viet Cong had been flushed from the tunnels and no additional prisoners were taken, ". . . for the most part the use of gas in the Vietnam war has not been successful."

The military has responded to this fact in a characteristic fashion: by gradually escalating the amount, concentration, and toxicity of the gases used.

Tear gas and adamsite have been widely described by Washington and Saigon officials as non-lethal agents. But what does non-lethal mean? Two Harvard doctors, writing in a 1966 issue of the *New England Journal of Medicine*, noted that CS, CN, and DM "are incapacitating, but usually non-lethal, although they can kill under certain circumstances: extremely high concentration of agent or highly susceptible victim, such as the very young, the very old or the very sick." Such circumstances are inevitable in South Vietnam; it is virtually impossible to deliver chemical agents at uniform dose levels in the field.

Not only the young, old, or sick can be killed by riot control gases. A Routers dispatch reprinted in *The New York Times* (Janaury 13, 1966) reported that non-lethal gases being used against Viet Cong guerrillas in tunnels northwest of Saigon killed one twenty-four-year-old Australian soldier and sent six others to the hospital. The dispatch said the soldier had died of "asphyxiation although he was wearing a gas mask." The Australians were taking part in a U.S. offensive.

More striking evidence of gas warfare's potential for death was provided in a letter from a Canadian physician in South Vietnam to Dr. E. W. Pfeiffer, a Professor of Zoology at the University of Montana who has been leading a fight to get some of his colleagues to investigate the use of CBW agents in the war. In the letter, Dr. Alje Vennema of Burlington, Ontario, told of his experiences with gas victims while serving in Quang Ngai Provincial Hospital. Dated November 23, 1967, his letter said in part:

"During the last three years, I have examined and treated a number of patients; men, women and children who have been exposed to a type of war gas the name of which I do not know. The type of gas used makes one quite sick when one touches the patient or inhales the breath from their lungs. After contact with them for more than three minutes, one has to leave the room in order not to get ill.

"The patient usually gives a history of having been hiding in a cave or tunnel or bunker or shelter into which a canister of gas was thrown in order to force them to leave their hiding place. Those patients that have come to my attention were very ill with signs and symptoms of gas poisoning similar to those that I have seen in veterans from the First World War treated at Queen Mary Veteran's Hospital in Montreal. The only difference between the cases was that these Vietnamese patients were more acutely ill. . . .

"Patients are feverish, semi-comotose, se-

[2] Similarily adamsite was used during the Marine attack on the Citadel at Hue after the Viet Cong's successful Têt offensive in February, 1968. UPI correspondent Richard V. Oliver reported that US planes dropped the gas in enemy areas "to soften up the guerrillas for Marine ground attack." The Washington *Evening Star* carried the dispatch on February 14 under the headline: "Use of Nausea Gas Reported in Attack To Soften Up Foe."

verely short of breath, vomit, are restless and irritable. Most of the physical signs are in the respiratory and circulatory systems . . . The mortality rate in adults is about 10 per cent while the mortality rate in children is about 90 per cent. I have kept accurate records of the number of such cases that I have seen only since June, 1967. Since then I have seen seven cases of which:

"There was one child of six years of age who died.

"There was one child of fifteen years of age who survived.

"There was one lady of approximately 40 years of age who died.

"There were four other adults who survived."

Dr. Vennema left the Quang Ngai Hospital shortly after writing his letter; the gas he was writing about apparently was adamsite (DM).

As I have noted, military manuals have careful restrictions on DM, warning that it should only be used were possible deaths are "acceptable." In Special Publication 2-31, published in 1960 by the Army's main chemical warfare center, the Edgewood, Md. Arsenal, a researcher named Bernard P. McNamara discussed the medical aspects of chemical warfare:

"Very severe exposures to tear gas or adamsite can produce damage to the respiratory tract. Adamsite is arsenical and, although remote, there is the possibility of systemical arsenical poisoning. This may be recognized and differentiated from effects of tear gas by marked nausea and vomiting which may persist for an hour or more after poisoning."

The failure, thus far, of riot control gases appreciably to affect enemy troops in Vietnam has apparently started some officers to think about a further escalation—this time to the incapacitants. During House appropriation hearings in March, 1967, General Betts, head of Army Research, was asked if the protests at the University of Pennsylvania against CBW research had hindered any of the Army's work. Betts replied: "I know of no impact that they have had on our efforts to date, other than harassment. I do feel that some of our policy concern with regard to pushing the use of incapacitating agents may be a reflection of these pressures. I just do not know."

Just what Betts was referring to isn't clear. On January 5, 1966, the *Wall Street Journal* reported that the Joint Chiefs of Staff were considering a proposal to "expand" the use of non-lethal chemicals in South Vietnam. The Chiefs "are expected to favor and forward the idea to President Johnson within the next few weeks," the *Journal* said. "The decision is up to him." As I have pointed out, by early 1966 the military was again given free rein to use riot control and nausea gases again in the war. If the Chiefs were urging approval of incapacitating agents which would have expanded the chemical arsenal, that proposal apparently was turned down.

BZ is currently the only incapacitating chemical agent in the military stockpile. Its use in Vietnam has been reported by Pierre Darcourt of *L'express*, who described in some detail an attack by the 1st Airmobile Division, involving BZ hand grenades, which took place in March, 1966. Darcourt said only 100 guerrillas of the 350- to 500-man Viet Cong force under attack escaped after exposure to the chemical. U.S. officials in Saigon and Washington have repeatedly denied that BZ has been used in Vietnam, although the agent is available in a field dispenser and a 750-pound bomb. It is not, however, available in hand grenades, according to *Chemical Reference Handbook* of the Department of the Army, published in January, 1967. Still, the record does not offer great hope of any permanent limitation on its use.

Some critics of the Vietnam war have charged that the United States is already waging a subtle form of germ warfare—simply by not doing everything possible to stem the increasing number of naturally occurring cases of bubonic plague. In 1961 eight cases of plague were reported in South Vietnam; by 1965 the number was estimated at 4,500. The London *Times* reported in late 1966 that "the increase [of plague] has been relentless. In 1961 only one province in the combat zone was affected. Today, 22 out of 29 provinces north of Saigon have been hit by the plague."[3] *Time* Magazine has reported that "plague has no significant effect on US troops, since every man received two shots before arriving in Vietnam and boosters every four months. For Vietnamese living under Government control, vaccine and treatment are almost always nearby. But for the enemy Viet Cong, North Vietnamese troops, and those living in VC-held areas, the plague may well become a more deadly killer than either side expected."

Peace News, a London anti-war weekly newspaper, noted in October, 1966, that the filth, garbage, and rubble that accompany war are natural breeding grounds for the rats and other animals that carry plague fleas. "Under modern hygiene, speedy diagnosis, and prompt treatment, plague can be isolated, contained, and eventually eradicated," the newspaper said. "But these conditions do not apply in Vietnam today." Further evidence of this came on January 29, 1968, when the World Health Organization reported that the plague had spread in South Vietnam in "epidemic proportions," accounting for 330 deaths and more than 5,000 illnesses in less than eleven months of 1967. The threat that the disease might begin spreading to other nations had aroused worldwide apprehension, WHO said.

The plague situation steadily worsened during the first three months of 1968, although that fact was not reported by most American newspapers. Only the London *Times*, revealed, on March 26, that Saigon itself was threatened by a major outbreak of plague in Tay Ninh Province, fifty miles to the north. The *Times* said that about 150 cases had been reported and the province placed in quarantine, with police supervising the vaccination of travelers at roadblocks. Moreover, cases had been reported from neighboring provinces closer to Saigon:

"The danger is that the disease may spread to Saigon, with its huge rat population and insanitary, crowded conditions, and be carried to other countries in merchant ships, or spread across the border from Tay Ninh into Cambodia."

The day after the *Times* report, US embassy officials in Saigon told Reuters that the outbreak of plague was far worse than anyone had admitted. South Vietnamese health officials had reported only eight deaths from plague in the first eleven weeks of 1968, but the US officials said the true figure was fifty-six deaths, with more than 700 suspected cases reported between January 1 and March 16. Moreover, according to Reuters, American and South Vietnamese Army doctors had averted what could have been a serious epidemic in mid-March in the Long Khanh Province forty miles northeast of Saigon by a huge program of inoculation of vaccines and antibiotics. These medical efforts, however, were not made until six civilians had died from the disease.

The plague traditionally in endemic to South Vietnam, but WHO officials told the *Manchester Guardian* (March 27) that, because of the war, conditions for the spread of the disease were ideal. The Viet Cong's successful Tet offensive and the savage US response, which included the bombing of widespread residential areas in Saigon's Cholon sector, has disrupted the WHO's effort to improve sanitary conditions and starve out the city rats. Ironically, the heavy American use of defoliants and herbicides in the Viet Cong-held areas near Saigon may have added to the rat population in Saigon: food now is much more plentiful in the city gutters than in some parts of the countryside.

The *Guardian* described South Vietnam as having "for some months been in the grip of an epidemic . . . [of plague]." If there was some urgency in the British reports on the situation, there was no sign of it in US newspapers or in Washington. Early in April I inquired at the Pentagon about the spread of plague, and found an air of mystification. There were no statistics available, no officers who knew anything about it, and no mention of the outbreak of the disease in the voluminous twice-daily press briefing reports that are filed to Washington from Saigon. It seems that, so far as the US military is concerned, plague in South Vietnam is not the white man's burden.

In These essays I have tried to show how the American military machine is making use of chemical warfare, with secrecy and in a war in an unsophisticated country 8,000 miles away—the kind of war that enables military men to talk about Vietnam as a playground for developing new war concepts and revitalizing the old. What about the future, now that the use of highly toxic chemicals and gases has become a standard fixture in the American arsenal? If adamsite can be used with impunity today and found wanting, what about nerve gas and biological warfare agents such as anthrax, tularemia, and brucellosis? The United States has violated a long-standing and respected Geneva agreement—which stood throughout World War II and the Korean War—by its use of chemicals and gases in South Vietnam. It has set a dangerous precedent, which was followed by Egypt when it used nerve gas against the Royalists in Yemen, early in 1967. Beyond that, the new American gas arsenal is being put to use as a riot control device almost every day in the United States, with the development of such chemicals as MACE. That America had so readily accepted the widespread use of gas and chemicals is ominous; it reflects the lack of information about gas and chemical warfare in Vietnam. For in Vietnam, as we have seen, when chemicals fail to meet their military objectives, new and more potent ones are used. Today we use chemicals to make both Vietnamese civilians and American protestors suffer with tears, nausea, and wracked lungs; tomorrow we may systematically start to give them the plague.

[From the New York Times Magazine, Aug. 25, 1968]

THE SECRET ARSENAL

(By Seymour M. Hersh, Washington-based freelance writer; wrote "Chemical and Biological Warfare: America's Hidden Arsenal")

WASHINGTON.—The Dugway Proving Grounds, main weapons-testing center for America's chemical and biological warfare (C.B.W.) research program, is a well-isolated military base; most of its one million acres are spread across the Great Salt Lake Desert in western Utah. The base's eastern edge—and the only access road to it—is about 80 mountainous miles west of Salt Lake City. In between are some small mountain ranges and sparsely inhabited valleys, where ranchers control vast acresge and thousands of sheep graze.

Until this spring, most Americans had

[3] The threat of plague has grown so intense that late in 1966 the US Public Health Service increased its surveillance of all cargo traffic from South Vietnam to the United States. More than 550 PHS workers were assigned to Vietnam; their job was to inspect each plane before it left, and again when it arrived in the United States to make sure no rats had climbed on board.

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never heard of the proving grounds, although Dugway has been testing chemical and biological weapons since World War II. The base's obscurity ended in March.

At 5:30 P.M. on Wednesday, March 13, an Air Force jet flew swiftly over a barren target zone and sprayed 320 gallons of a highly persistent, lethal nerve agent known as VX during a test of two new high-pressure dispensers for the gas. The test site was about 30 miles west of Skull Valley and about 45 miles west of Rush Valley, two large sheep-grazing areas. The site also was about 35 miles south of U.S. 40, one of the nation's most heavily traveled highways and a main link between the Midwest and California.

The winds were blowing from the west that day, with gusts reaching 35 miles an hour. Testing in strong winds was nothing new to the Army researchers; since the early nineteen-fifties millions of dollars had been spent on meteorological equipment and gauges at Dugway, and the scientists had long been able to predict accurately the dispersal of the killer gases—or so they thought.

On Thursday the sheep began to die in Skull and Rush Valleys. By Sunday more than 6,000 sheep were dead, and the top command at Dugway was informed of the outbreak by the ranchers. Veterinarians began inoculating thousands of sheep that day, but found that none of several vaccines used had any effect.

A week after the secret test flight, the Salt Lake City newspapers published dispatches telling of the mysterious sheep deaths and linking them to "some kind of poison." A spokesman for Dugway told the newspapers that tests on the base "definitely are not responsible" for the deaths. "Since we first found out about it," the official said, "we checked and found we hadn't been running any tests that would cause this."

How long the Army would have gone without telling the ranchers of the nerve gas tests is problematical; when the facts became known, it was an accident. On Thursday, March 21, the Pentagon responded to a request for more information from Senator Frank E. Moss, Utah Democrat, by sending a fact sheet to his office marked "For Official Use Only," an informal security classification intended to prevent public release. A young press aide in Moss's office promptly made the fact sheet public; the Army's attempt hours later to retrieve the document was too late.

The military quickly canceled all aerial spray tests at Dugway and spent the next three weeks issuing denials that nerve gas from Dugway had anything to do with the death of the sheep—even in the face of medical reports directly linking them to organic phosphate compounds (nerve gas is one such). On April 18, the Army acknowledged that "evidence points to the Army's involvement in the death of the sheep." By this time, the case of the poisoned sheep received little attention in the press.

The military's performance in the Dugway affair was consistent with its long-standing avoidance of public discussion of the controversial chemical and biological warfare program. Yet C.B.W. is a major effort, as can be seen in this partial catalogue of America's arsenal.

CHEMICALS: Odorless, colorless nerve gases that paralyze the nervous system and kill in minutes . . . strong anesthetic or psychochemical gases that produce temporary paralysis, blindness or deafness and can cause maniacal behavior . . . tear gases, one of which has the scent of apple blossoms, that can incapacitate in 20 seconds and, in heavy concentration, cause nausea . . . improved versions of World War I gases like adamsite (headache, nausea, chest pains) and mustard gas (lung and eye burns, blisters) that can kill in heavy doses . . . defoliants (for trees) and herbicides (for food plants) that in low dosage are not toxic to man—though heavy concentrations cause illness and, in the case of those with an arsenic base, may cause arsenic poisoning.

BIOLOGICALS: Specific agents are unknown, but the military is known to have studied the following highly contagious diseases with C.B.W. intent—anthrax, fatal within 24 hours if it attacks the lungs . . . bubonic plague (the Black Death) and pneumonic plague . . . Q-fever, acute but rarely fatal, caused by an organism that can remain alive and infectious for years on end . . . encephalomyelitis, ranging from debilitating to fatal . . . brucellosis, also known as undulant fever. Using genetic knowledge and techniques developed within recent years, Army scientists have been able to devise subtle new strains of some of these diseases, changing their cellular make-up so that they become resistant to known antidotes.

When asked why the United States is developing its C.B.W. arsenal, military men at the Pentagon refer to a statement made by then Deputy Secretary of Defense Cyrus Vance during March, 1967, hearings before the Disarmament Subcommittee of the Senate Foreign Relations Committee.

After explaining that the United States seeks international agreements to curb the spread of C.B.W., Vance added: "As long as other nations, such as the Soviet Union, maintain large programs, we believe we must maintain our defensive and retaliatory capability. It is believed by many that President Roosevelt's statement in 1943, which promised 'to any perpetrators full and swift retaliation in kind,' played a significant role in preventing gas warfare in World War II. Until we achieve effective agreement to eliminate all stockpiles of these weapons, it may be necessary to be in a position to make such a statement again in the future."

The U.S. and the U.S.S.R., at any rate, are not alone in developing C.B.W. arsenals. Since World War II at least 13 other countries—Britain, Canada, Communist China, Nationalist China, France, West Germany, Poland, Sweden, Spain, Egypt, Cuba, Israel, and South Africa—have either publicly revealed that they are doing C.B.W. research, reluctantly confessed that they are doing "defensive" C.B.W. research, been accused of using such weapons or actually have initiated gas warfare in combat.

There have been, over the years, international efforts to curb chemical and biological arms production and use. A treaty prohibiting gas warfare was signed by Germany, France and other nations (not including Britain or the U.S.) at The Hague in 1899. It didn't stop gas warfare in World War I. Similar treaty negotiations failed in 1921, but four years later at the Geneva Conference a treaty was signed outlawing the "use in war of asphyxiating, poisonous or other gases, and of all analogous liquids, materials or devices." The U.S., Japan, Czechoslovakia, Argentina and Brazil did not sign. The United Nations passed a resolution in 1966 urging all countries to abide by international law affecting C.B.W. And just this month the British Government urged that a new international convention be drafted to update the Geneva ban. Meanwhile the weapon race has gone on.

American officials have made it plain that this nation consider itself bound by the Geneva treaty; they insist that the use of crop-killing chemicals and riot-control gases in Vietnam does not violate the treaty's ban. But critics here and abroad take strong issue with the U.S. interpretation of the treaty language—less than two weeks ago the Soviet Union charged that American use of chemicals in Vietnam violated international law. Critics also point out that American use of non-lethal gas in Vietnam has already escalated. Initially tear gas was used to control crowds or to clear bunkers—the intent being to prevent unnecessary loss of civilian and military lives. Now the South Vietnamese and American forces deploy nausea gas to clear out enemy bunkers—the intent being to set the enemy up for bombing missions. Fear of such escalation has historical precedent. As Elinor Langer noted in a series on C.B.W. in Science magazine last year, most of the World War I gas warfare deaths resulted from mustard gas, which was not introduced into combat until after both sides had tried tear gas.

The controversy over C.B.W. has elements in common with those that accompanied the development of nuclear weapons. Thus proponents warn that other nations are ahead of the U.S. and speak of a chemical-biological "gap." Opponents insist that the American program is fostering a proliferation of C.B.W. weapons. But the whole subject has overtones of horror and revulsion that far outstrip the world's fears of a nuclear holocaust.

During World War II, chemical and biological warfare was a top-secret area of research in America. The research was continued after the war, but on a reduced level—during much of the nineteen-fifties, at between $50-million and $75-million a year; enough only to sustain existing programs. But in the last years of the Eisenhower Administration, C.B.W. spending increased, and in the fiscal 1962 budget, the one inherited by President John F. Kennedy, nearly $100-million was recommended. Over the next three years, as the Kennedy Administration moved from an overreliance on nuclear weapons toward a more flexible defense posture—with an emphasis, for example, on counterinsurgency methods—C.B.W. spending climbed to nearly $300-million a year with as much as 30 per cent of its budget earmarked for the manufacture of delivery systems such as bombs, shells and spray devices.

The last C.B.W. budget made public, for fiscal 1964, included a total of $157.9-million for research into C.B.W. agents, most of it for the Army Chemical Corps, and $136.7-million for the procurement of delivery systems. It is not known if maintenance and construction costs and wages are included in these totals. Today procurement costs are still classified, but Pentagon officials say spending on research has dropped by 5 per cent each year since 1964. It seems clear, however, that the overall investment in the C.B.W. program has grown with the advent of the Vietnam war. More than $70-million will be spent in the fiscal year that began July 1 on the purchase of defoliants.

The Army is generally responsible for the nation's C.B.W. work. The Navy and Air Force both have rapidly expanding programs but must conduct much of their research at Army installations on a pay-as-you-go basis. The Army operates five high-security C.B.W. bases and has leased another to a private firm (see box, left); aaccording to statistics made available by the bases, more than 3,750 officers and men and 9,700 civilians are employed in the system. The total value of the bases is about $1-billion; all have ambitious building programs.

The huge increases in research spending in the early nineteen-sixties enabled the Pentagon to turn more and more to the aerospace corporations and the multi-universities for aid in solving the complex meteorological and biochemical problems involved in spreading germs and gases in air and/or water. By 1964 all of the military's C.B.W. research facilities were fully computerized, and expensive research into such fields as biomathematics was making it possible to know beforehand how the agents could be most effectively dispersed.

The result was inevitable: major advances along the entire spectrum of chemical and biological warfare. Scientists—working at military bases, at more than 70 universities around the world, at an even greater number

of private and nonprofit corporations—have perfected a massive array of deadly agents. Complex delivery systems have been evolved: germs and gases have been successfully tested in guided missiles, hand grenades, bomb clusters, artillery shells and aerosol sprays. It is known that gas-carrying weapons have been distributed to U.S. forces throughout the world. There is no evidence of any similar distribution of germ-bearing weapons, but they are known to be stored in this country.

The military has consistently refused to make public many of the facts about C.B.W., including details about the Soviet program. When I asked one military man the reason for this policy, he said there is "very little one can say because it reveals our intelligence sources." Yet Pentagon officials have, on occasion, when seeking additional funds for C.B.W., talked on the record about the Russian effort.

In 1960 Lieut. Gen. A. G. Trudeau, then Chief of Army Research, told a House subcommittee on Defense appropriations that "we know that the Soviets are putting a high priority on development of lethal and nonlethal weapons, and that their weapons stockpile consists of about one-sixth chemical munitions. Russian leaders have boasted that they are fully prepared to use new chemical weapons of great significance, and we know Soviet forces are trained in their use."

The generals have consistently told Congress that Russia is ahead in C.B.W. development. Former Defense Secretary Robert McNamara testified at House hearings on the 1969 Department of Defense budget that America's C.B.W. position was "adequate at the present time." He added: "The Soviets probably continue to do more than we do in this field, however."

A 1960 Army report to Congress stated that the Russians had within each military division "a specific unit devoted to the field of chemical warfare" and that they had large stockpiles of nerve gas. The report added that "Soviet medical and technical reports . . . show that they are equally well versed in biological warfare." And a Soviet general was quoted as saying: "Many of our scientists . . . regard research on the actions of poisons and on the development of antidotes to be their patriotic duty." In this report and elsewhere, mention has been made of a nationwide C.B.W. civil defense program in Russia; yet the importance of protecting the public against C.B.W. has certainly not been a preoccupation in this country. Neither the Defense Department nor any civil defense agency has made any significant attempt to inform the American public about the possible threat of such an attack; few gas masks are available for civilians; government warehouses have only a limited supply of the antibiotics and other antidotes that would be needed.

The need for what defense officials call "retaliatory capability as a deterrent" is only one of the arguments the U.S. military presents for continuing or even expanding the C.B.W. program. Another, as expressed in an interview with a high-ranking Pentagon officer: "In order for us to develop defenses against the tactical use of C.B.W. weapons, it's necessary to know what their offensive capabilities are. We've got to push the offensive as much as possible." Masks and protective shelters, plus antidotes for germ agents, are the only defense mechanisms now available. Large-scale programs dating back to the early nineteen-fifties have sought to evolve an early-detection system, but no substantial progress has been reported.

For many military planners, the appeal of C.B.W. lies in what they term its "humaneness" and "efficiency." "It can be just as disagreeable as any of the other forms of destruction in vogue in the world," an Army presentation admits, "yet it also offers some rays of hope for a more sane approach to an activity which we wish could be classified as irrational." Thus C.B.W. can be practiced over "a whole gradated spectrum of degrees of severity, and at the milder end of the spectrum may represent a far lesser evil than many presently accepted forms of warfare." The report goes on to cite the taking of Iwo Jima in 1945, with the loss of 28,000 Japanese and American lives: "If the new incapacitating agents had been available, it is conceivable that neither side would have lost any appreciable number of men."

Air Force Col. Jesse Stay, deputy director of information at the Pentagon, told me bluntly: "We're using herbicides and riot control agents in Vietnam. Everybody knows we're using them. They're serving a good purpose. Nobody's hidding the fact that they're being used—and nobody's ashamed of that fact."

The use of riot-control gases and defoliants in Vietnam has, however, seemed inadequate to some military men. In October, 1966, two retired generals had their say on the subject. The director of chemical warfare research in the nineteen-fifties, Brig. Gen. J. H. Rothschild, called for the use of mustard gas in clearing land and rendering Vietcong bunkers useless; it would, he added, "save lives, not only of Americans and of our allies but also of the enemy." And Maj. Gen. John Bruce Medaris, former commander of the Army Ordnance Missile Command, advocated the use of nerve gas.

In a recent letter to The New York Times, General Rothschild summed up many of the arguments for the C.B.W. program:

". . . if the United States is forced into a large-scale war against superior manpower, e.g., a nation such as Communist China, we cannot afford to meet on a man-to-man basis, as we did in the Korean war, when we took large numbers of unnecessary casualties. . . . [We] will have to use weapons of advanced technology. These include the nuclear weapons, chemical weapons or biologicals. We don't want to use nuclear weapons certainly, because of the danger of worldwide involvement with the completely unacceptable physical damage which would result, the great loss of life and the possibility of genetic effects. The use of chemical weapons could eliminate all of these dangers but still give us the means of successfully combating the superior manpower. Furthermore, it could result in the saving of large numbers of civilian lives."

Criticism of America's C.B.W. program has come primarily from two groups—scientists, both within and outside the military and students. Criticism ranges from those who, as one top Pentagon planner expressed it, want "restraints" on the program and an emphasis on defensive techniques to those who call for a complete and total phasing-out of C.B.W. activities. In recent months the Federation of American Scientists has urged discontinuance of C.B.W., which it said is not in the nation's interest. Member protests have led the American Society of Microbiology to poll its membership on the question of continuing its long-standing agreement to serve Fort Detrick in an advisory capacity. In April at least 16 scientists refused to take part in a symposium on genetics at Fort Detrick. A two-year protest by students at the University of Pennsylvania led to the university's cancellation of two secret C.B.W. research projects, worth $845,000 a year, and similar protests are under way at dozens of other campuses.

Inevitably, the arguments against chemical and biological weapons have a strong emotional overtone; the subject is almost too horrible for rational debate. This distaste for C.B.W. even pervades parts of the Pentagon; some military men I spoke with conveyed the impression that the use of gases and biologicals isn't manly: it isn't the kind of warfare that cadets learn about at West Point; it's "sneaky."

But the criticism is by no means limited to emotional appeals. Some opponents, for example, are concerned that by advancing the C.B.W. state of the art the U.S. is handling small, possibly irresponsible nations a deadly weapon. Matthew Meselson, a prize-winning Harvard University biologist, last year told an interviewer for the Harvard Alumni Bulletin that the C.B.W. program places "a great premium on the sudden, unexpected, hopefully decisive blow, on the order of Pearl Harbor. So we have here weapons that could be very cheap, that could be particularly suitable for attacking large populations, and which place a premium on the sudden, surprise attack. . . . If you look at the engagements in which the United States has been involved in the past, or try to think of those in which we might in the future, it seems to us that these are just those characteristics which we should not want in weaponry—you could almost not ask for a better description of what the United States should not want to see happen to the art of war."

Other critics look upon the American use of C.B.W. weapons in Vietnam as a violation of the spirit, if not the letter, of the Geneva Convention—and most believe that the letter, too, has been violated. They listen to the arguments that the chemicals used in Vietnam are humane, and they ask questions such as those posed by Prof. William V. O'Brien, international law expert at Georgetown University, during a 1966 campus debate:

"Is it opening . . . Pandora's box? Is it getting into a category of things hitherto banned which, once opened, can go on and on and on? You say, well, it's not too bad to make people cry. Well, perhaps the next argument is it's not too bad to give them the three-days' flu. And then you work your way up from that to something else, and after a while you get into countermeasures and pretty soon the thing is really spiraling out of hand."

Of great concern to many scientists is another unanswered question of biological warfare: Can disease, once spread, be controlled? Dr. Theodor Rosebury, a Chicago bacteriologist who did biological warfare work during World War II, has written that "it is next to impossible to know beforehand what to expect from a strategic B.W. [biological warfare] attack; there is no satisfactory way of testing it in advance." Thus, some argue, to initiate the use of plague or anthrax, diseases that can kill more than 90 per cent of their victims, would be to set in motion a doomsday machine on the planet—striking down attacker and defender alike. The Pentagon consistently refuses to discuss such questions with newsmen, but it is well aware of the unpredictability of B.W. Writing in a medical school journal in 1964, Dr. Leroy D. Fothergill, former director of the laboratories at Fort Detrick, offered this assessment of the effects of a major B.W. attack:

"It is possible that many species would be exposed to an agent for the first time in their evolutionary history. We have no knowledge of the range of susceptibilities of these many species of wildlife to specific micro-organisms, particularly through the respiratory route. . . . What would be the consequences? Would new and unused zoonotic foci [animal transmitters] of endemic disease be established? Would it create the basis for possible genetic evolution of micro-organisms in new directions, with changes in virulence for some species? Would it create public health and environmental problems that are unique and beyond our present experience?"

These sorts of ecological and epidemiological problems are being studied intensely at Fort Detrick and the Dugway Proving Grounds. Scientists there believe that with

accurately the effects of a biological attack. Many knowledgeable C.B.W. critics have their doubts.

An indication of the complexity and importance of C.B.W. considerations is to be found in the varying views on the question of possible unilateral disarmament by the U.S. in the C.B.W. field. Critics of the program argue that nuclear weapons provide all the deterrent needed to forestall any enemy C.B.W. attack. Their opposite numbers in the military claim that reliance on nuclear retaliation alone would, in fact, seriously weaken the deterrent to biological attack. They point out that some of the possible biological warfare diseases have three- or four-day incubation periods before they break out. Would the United States be willing to unleash nuclear missiles, they ask, four days after a biological attack was confirmed, and tell the world it was "retaliating"? If not, it is argued, a policy resting only on a nuclear deterrent could encourage C.B.W. attack, rather than deter it.

Though the controversy over America's C.B.W. program is bitter, there is general agreement on at least two points: it is essential that the world never be exposed to the ravages of a chemical-biological war; a de-escalation of the C.B.W. arms race, followed by international disarmament agreements, is a possible means to that end.

Once again the situation has elements in common with the nuclear arms race. If there is to be any meaningful international accord on C.B.W., many Administration experts feel, there must be some scientifically valid procedure for policing it. Studies of detection systems are being conducted by scientists, including some Americans, working with the Stockholm International Police Research Institute. But progress has been slow. Last year the Johnson Administration allotted the Federal Arms Control and Disarmament Agency only $100,000 for research into C.B.W. control and detection.

What is desperately needed, if the world is to move toward an answer to the C.B.W. problem, is an open, rational public debate of the political and military implications involved. The Vietnam war, the campus protests over military research contracts, the trouble at Dugway Proving Grounds, the disenchantment of large segments of the scientific community—all these have set the stage for such a debate in this country. But it cannot begin until more information is made available. The Pentagon should immediately re-evaluate its security restrictions about C.B.W. If Russia is indeed engaged in a major C.B.W. build-up, this information should be made known. The types of agents, their possible effects and the national policy surrounding actual deployment of chemicals and biologicals should be released for public evaluation.

Americans—and Russians—know a great deal about the horrible consequences of atomic attack; this knowledge is as significant a deterrent as the I.C.B.M. rockets shielded deep in their silos. If the world knew more about the potential horror of nerve gases and deadly biologicals, the drive for de-escalation and disarmament would be increased. And the United States, as one of the leaders of C.B.W. research and development, would have an obligation to lead that drive.

[From the New York Times Magazine, Aug. 25, 1968]

Hersh

CBW Bases and What They Do

Because of the secrecy surrounding the C.B.W. program, it is impossible to detail completely the functions of the military bases involved. What follows is necessarily a capsule summary.

Fort Detrick, Maryland: This base, about 50 miles northwest of Washington, D.C., serves as the headquarters for the nation's biological warfare research program. Detrick controls the procurement, testing, research and development of all biological munitions and products, including all defense approaches (such as masks and vaccines). The emphasis at Detrick, however, is on the offense. The fort was set up during World War II and has been one of the world's largest users of laboratory animals since—perhaps as many as 720,000 mice, rats, guinea pigs, hamsters, rabbits, monkeys and sheep a year. Most of the nation's military work on anti-crop devices and defoliants is conducted in a corner of the base where, behind high wire fenses, scientists work in a cluster of greenhouses.

Pine Bluff, Arkansas: This arsenal usually is described in military organization charts as serving primarily as a chemical munitions base. Indeed, it was opened in 1942 as a chemical facility and still serves as an important packaging and production point for smoke bombs, incendiary munitions and riot-control agents (including CS, the potent tear gas used in Vietnam). But Pine Bluff does its most important work for the biological laboratories at Fort Detrick. It is the main center for the massive production and processing of biological agents. The germs are not only brewed in heavy concentration there but are also loaded into bombs, shells and other munitions, most of which are in cold storage depots, known as igloos.

Dugway Proving Grounds: This base tests biological as well as chemical agents and is also an important research center. Studies in ecology and epidemiology have been under way for years to determine just what happens to an area after many years of testing with highly infectious biologicals. (Similar test projects are sponsored by Dugway at other locations in the nation.) The problems are incredibly complex: more than 10,000 species of life are known to exist on the huge base.

Edgewood, Maryland, Arsenal: Edgewood is the oldest of the C.B.W. bases; it dates back to World War I, when it served as a manufacturing site for shells containing phosgene and other gases. It was the central plant for the production and filling of gas munitions until the end of World War II, when it was switched to research and development. Edgewood's first major job in this area was to study the nerve agents, produced by the Germans, that Allied intelligence had shipped home. A pilot plant to produce one such—Sarin, otherwise known as G.B.—was built and in operation on the base by the late 1940's. The arsenal is now the management and final inspection center for all chemicals and chemical weapons.

Much time and money are invested at Edgewood in the quest for the perfect incapacitating agent, presumably a psychochemical or anesthetic weapon. The only such agent known is BZ, and it has yet to see combat use. The chief problem with the incapacitating agents is the requirement for a uniform dosage level—that is, they must be capable of being spread evenly; otherwise, they might kill in areas of high concentration and have no effect at all in areas of lower concentration.

Rocky Mountain Arsenal: This 17,750-acre base is 10 miles northeast of Denver and served as the main production facility for the nerve gas Sarin after initial tests at Edgewood demonstrated its feasibility as a weapon. Production of the gas was halted in 1957 after three years of furious, around-the-clock activity (insecticides are now manufactured here) but the arsenal has remained busy filling rockets and bombs with it.

The Newport Chemical Plant: This installation in farm country on the western edge of Indiana, near Danville, Ill., is the Army's main production plant for VX, an improved nerve gas that did not enter the military's arsenal until the early 1960's. (VX, unlike Sarin, does not evaporate rapidly or freeze at normal temperatures. Its low volatility makes it effective for a longer period of time.) The plant was built by the Food Machinery and Chemical Corporation (F.M.C.) under a 1959 Army contract and has been operated ever since by that company. Newport produced VX nerve gas on a 24-hour schedule until late 1962, when production was slowed.—S. M. H.

[From Science, Jan. 13, 1967]

Langer

Chemical and Biological Warfare (I): The Research Program

(Note.—Biological warfare is the intentional use of living organisms or their toxic products to cause death, disability, or damage in man, animals, or plants. The target is man, either by causing his sickness or death, or through limitation of his food supplies or other agricultural resources. Man must wage a continuous fight to maintain and defend himself, his animals, and his plants in competition with insects and microorganisms. The object of BW is to overcome these efforts by deliberately distributing large numbers of organisms of native or foreign origin, or their toxic products, taking full advantage of the ability to utilize more effective methods of dissemination and unusual portals of entry. BW has been aptly described as public health in reverse.—"Effects of Biological Warfare Agents," pamphlet published by Department of Health, Education, and Welfare, July 1959.)

During the last 18 months, the University of Pennsylvania has from time to time been the unhappy object of national attention arising from dislosures that the university is conducting secret research for the Army and Air Force on chemical and biological weapons. In an interview with *Science* last fall, one troubled university official complained that Penn's participation in CBW was being unfairly singled out. "There are a lot of people in this game," he said. He was right.

The chemical and biological weapons program is one of the most secret of all U.S. military efforts—not because it is the most important of our military R&D activities, but because the Pentagon believes it is the most easily misunderstood and because it provokes the most emotional distress and moral turbulence. Official secrecy makes a complete portrait of the CBW program difficult to construct. Rumors fly freely around the security wall that separates the "ins" from the "outs." In some portions of the scientific community the Johnson administration's "credibility gap" has taken its toll and there is readiness to believe that, every time some one in Vietnam sneezes, it is because the United States is distributing the germs. In the defense establishment the CBW program is represented as being some kind of cross between defensive preparations, on the one hand, and peaseful by-products in preventive medicine, on the other.

Defensive preparations are only one part of the program, for the United States is engaged in a comprehensive and flourishing R&D effort in chemical and biological weapons. It involves non-military as well as military agencies, industry as well as the academic community, and it has received cooperation from some of the major scientific institutions of the United States. Stockpiles of chemical and biological weapons produced by this program provide a far-ranging offensive capability. Furthermore, U.S. policy concerning the use of chemical and biological weapons is ambiguous and contradictory, and is rendered even more so by the use of chemical weapons in Vietnam.

The current CBW program is the product of decisions made and steps taken during the late 1950's and early 1960's. Before that time the old-line Army Chemical Corps was regarded by the nuclear-age military establishment as custodian of a particularly controversial and probably useless emporium. The Chemical Corps had a message it had been repeating since World War I—that its

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wares were unusually humane—but no one was buying. The Corps existed on budgetary dregs, usually around $35 million a year. Its most active support came from the Armed Forces Chemical Association, a group of military and industrial executives supported by chemical companies and "dedicated to scientific and industrial preparedness for the common defense in the fields of chemical, biological, radiological and related technology commonly referrred to as chemicals." The Corps felt continually threatened with the possibility that it would be abolished.

In 1959 the Corps took matters into its own hands and went to the public with a full-scale publicity campaign known as "Operation blue skies." It was a period of fascination with the possibility of "incapacitating" weapons, particularly psychochemicals, and, putting aside its more lethal products, what the Chemical Corps advertised—in articles, speeches, lectures, symposia, and Congressional appearances—was "war without death." Within a short time the Corps' hopes for expansion had won endorsements from a variety of outsiders, from the American Chemical Society to the House Committee on Science and Astronautics.

At the same time, the Kennedy administration came into office, concerned about the military inflexibility imposed by over-reliance on nuclear weapons. New Frontiersmen were interested in acquiring a more versatile weapons "mix." And they were especially interested in systems that, like CBW, seemed to offer particular promise in fighting limited wars. In the nuclear stalemate between the great powers, there began to be a reorientation in conceptions of how the U.S. would conduct its war against smaller nations, and CBW was just one beneficiary of the reorientation. Fantasies about battles in which whole populations would fall asleep while being captured provided a comforting alternative to the known, stark destructiveness of nuclear weapons, and also helped to establish the appeal of CBW. The relative cheapness of CBW systems played a role as well.

By 1961 CBW had ceased to be scorned, and a comprehensive program for improving U.S. capabilities was underway. In fiscal year 1961 the R&D budget for CBW for all three military services was about $57 million. By 1964 is had risen to about $158 million, with the Army's share being about $115 million. It is now roughly at that level or slightly lower. In 1961 only the Army had money for procurement—about $46 million. In fiscal year 1964 the Army received a little more than $117 million for procurement related to CBW; the Navy, $11 million; and the Air Force, $8.7 million. Procurement figures for more recent years are classified. (These sums for procurement are additional to the amounts spent for research and development.)

In addition to these annual budgets, there is a large standing capital investment in CBW activities. Fort Detrick alone, the center of biological warfare research, occupies 1300 acres of land near Frederick, Maryland, and has a building complex valued at $75,000,000. According to an employee-recruitment brochure, it has "one of the world's largest animal farms" and its "facilities for conducting research with pathogenic organisms are among the most advanced in the world."

Were it not for two things, Detrick might pass as nothing more than the particularly well-endowed microbiological research center it advertises itself to be. Research on basic characteristics of microorganisms seeks the same knowledge and is carried on in the same fashion whether the agency paying the bills is Detrick or NIH. Some of the research undertaken has a defensive motivation—an effort to discover means of combatting biological weapons that might be used by an enemy. Some of the research is neutral—not susceptible to utilization by a weapons program at all. But much of the work inescapably has a special character, an inverted quality like that of medicine turned inside out. It consists in part, for example, of efforts to breed into pathogenic organisms precisely the characteristics—such as resistance to antibiotics—that medical researchers would like to see eradicated. In the context of biological warfare even life-saving techniques such as immunization take on a strange aspect: immunity among one's own population and troops is a prerequisite to the initiation of disease by our own forces, as well as a precaution against its initiation by others. Some diseases are currently excluded from active consideration as BW agents chiefly because no vaccines against them have yet been developed.

A second factor separating Detrick from other research centers is the restraint placed on its researchers. Detrick's scientific staff consists of 120 Ph.D.'s, 110 M.S.'s, 320 B.S.'s, 34 D.V.M.'s, and 14 M.D.'s. Only about 15 percent of their findings are published through conventional scientific channels; the rest become part of a secret literature managed by the Department of Defense and available to other government agencies and contractors on a "need to know" basis.

While nothing is published that would indicate the relative degree of military interest in, or effort on, a particular agent, Detrick scientists do report in open literature on subjects such as instances of laboratory-induced or accidentally acquired infection, immunization, therapy, routes of infection in man and animals, and various experimental techniques. From these papers and from other sources it is possible to surmise a good deal about the Detrick research program.

Diseases that are at least the objects of considerable research and that appear to be among those regarded as potential BW agents include: bacterial diseases—anthrax, dysentery, brucellosis, glanders, plague, and tularemia; rickettsial diseases—Q-fever and Rocky Mountain spotted fever; viral diseases—dengue fever, several types of encephalitis, psittacosis, and yellow fever; a fungal disease, coccidioidomycosis; and botulism toxin.

In recent years a good deal of attention has been focused on plant diseases also. Recently the Army's Distinguished Service Medal, the highest award the Army gives civilians, was awarded to a Detrick researcher for her contribution to development of a rice blast fungus, a disease that in its natural form has repeatedly damaged Asian rice crops.

To make the jump from naturally occurring organisms to usable weapons, biological agents must possesa certain characteristics: they must be highly infectious; they must be able to maintain viability and virulence during production, storage, transportation and dissemination; they must be sturdy enough to withstand injury during dissemination and have a minimum decay rate; and they must be capable of being produced on a militarily significant acale. Judged from what has surfaced a substantial portion of fundamental research at Detrick has been devoted to development of these characteristics in the organisms producing the diseases listed (follows at end of article).

Detrick is also more or less the home of the science of aerobiology—the study of airborne infection—an area of much interest to researchers studying dissemination of disease, whether their interests are causative or curative. Aerobiology is of particular relevance to biological warfare, however, because the idea of disseminating infectious agents by aerosols—suspensions of small particles in the air—seems to be displacing earlier notions about how to transmit disease. Conventional images of biological warfare—the covert "man with the suitcase" or the poisoning of water supplies and ventilation systems—seems to have been discarded, partly because the number of people who could be subjected to infection at any one time is too small.

Two out of the three times Detrick has emerged to participate in a conventional way in the affairs of the scientific community, it has cosponsored conferences on airborne infection. (Its intellectual debut was a 1959 symposium on "Nonspecific resistance to infection," held in collaboration with the American Institute of Biological Sciences.) The first "Conference on airborne infection," held in Miami Beach in December 1960, was supported jointly by Detrick and the National Institute of Allergy and Infectious Diseases (NIAID), of the National Institutes of Health, and sponsored by the National Academy of Sciences. Detrick papers included "Viability and infectivity of microorganisms in experimental airborne infection." "Techniques of aerosol formation," and "Airborne Q fever."

Detrick's third meeting was the second International Conference on Aerobiology, held in Chicago last March and sponsored jointly with the Illinois Institute of Technology, a Detrick contractor. Papers by Detrick researchers included "Antibiotic prophylaxis and therapy of airborne tularemia;" "Physical and chemical stresses of aerosolization;" "Infection of pigeons by airborne Venezuelan equine encephalitis virus;" and "Attenuation of aerosolized yellow fever virus after passage in cell culture." Two papers reflected collaboration between Fort Detrick and NIAID: "Effect of route of inoculation on experimental respiratory viral disease and evidence for airborne transmission" and "Assessment of experimental and natural viral aerosols." A cooperative project between Detrick and the University of Maryland Medical School was a study of "Aerogenic immunization of man with live tularemia vaccine." A researcher at Ohio State University College of Medicine, supported by a Detrick grant, reported on "Aerosol infection of monkeys with *Rickettsia rickettsii*," the organism that causes Rocky Mountain spotted fever. Detrick, the University of Arizona, and the Public Health Service all cooperated in a study of "Experimental epidemiology of coccidioidomycosis," an infectious fungal disease.

PHS INVOLVEMENT

The Public Health Service has also cooperated with Detrick in other ways. In 1960, for example, the PHS received more than $380,000 in funds transferred from the Army Chemical Corps, and, according to a PHS spokesman, annual transfers of funds measure only a fraction of the real cooperation between the two agencies. The PHS says that it does not take Army money to conduct research that it would not otherwise undertake, but only to bolster ongoing projects in fields in which it has an independent interest. Its policy is that none of the research results obtained in collaborative projects may be classified. However, the subject matter of an Army–PHS transfer of funds oannot always he discussed because—even though it may concern an area in which the PHS is studying openly—the mere fact of military interest in it may be classified.

Apart from the transfer of funds there is active liaison between the two agencies—communication on several levels, and efforts on both sides to avoid duplication. And the PHS has also cooperated with Detrick by delaying required reporting to international health authorities of quarantinable diseases occurring at Fort Detrick. One such instance took place on 1 September 1959 when a 22-year-old enlisted technician named Ralph Powell became ill with pneumonic plague. The following day Detrick informed the Frederick County Health Officer, and on the second day it informed the Public Health Service. Its memo to the PHS, classified secret, statad that "no press release has been made or is contemplated by any DOD agency, un-

less death occurs. In such a case, the cause of death would not be announced." Powell recovered, the report was downgraded to "for official use only," and on 6 November the PHS reported the case. If the PHS is assured that no epidemic hazard exists, it allows the military's declaration of "national security" to take precedence over its international obligations.

Another source of advice for the biological warfare effort is the National Academy of Sciences. In addition to occasional formation of special groups to consider particular problems, the NAS has for several years sponsored a program of postdoctoral "Resident research associateships" designed in part to help bring talent into Detrick. The fellowships are supported by Detrick for research at the laboratories, but candidates are screened by the Academy. Appointees, who must be investigated and cleared, are subsequently permitted to describe themselves as having received an NAS–NRC fellowship.

Additional intellectual assistance for Detrick comes from the American Society for Microbiology, which maintains a permanent Detrick advisory committee. In 1966 the President of the ASM was Riley D. Housewright, scientific director of Fort Detrick. Detrick also uses the part-time consulting services of a number of individual researchers drawn largely from the academic community.

A MILLION DOLLAR SECRET

A number of universities and research institutes also have come into the CBW constellation. The terms of the research sponsored by Detrick or by its chemical-weapons counterpart, the research laboratories of Edgewood Arsenal, vary. Some of it is secret, some open. Some of it amounts to support for basic microbiological research in which Detrick and university-based investigators happen to have simultaneous interest; some is closer to a straight purchase of manpower for a particular task. The scale and magnitude of university-based CBW research is also variable, occasionally running—as at Penn—into large projects but most-often consisting of a few researchers together with perhaps a handful of graduate students.

Between 1955 and 1963, as an example of one end of the spectrum, John Hopkins received over $1 million for work described as "studies of actual or potential injuries or illnesses, studies on diseases of potential BW significance, and evaluation of certain clinical and immunological responses to certain toxoids and vaccines." Hopkins reports that its work, which is continuing at a reduced level, produced no results published in open literature. At the other end of the spectrum is the Duke University Medical Center, where researchers have been working since 1958 to develop a vaccine against Coccidioides immitis and have made several contributions to professional journals. Some of the CBW work, such as that performed in the late 1950's at Stanford University, is strictly classified; or, like that done at Brooklyn College, the New York Botanical Gardens, and the Midwest Research Institute, at least does not contribute to open literature. Most of the research seems to occupy an ambiguous middle ground where at least some fraction of the results may be publishable, but only with clearances, releases, and so forth from the Department of Defense. Among the institutions where researchers recently performed or are now performing work in this category are the Southern Research Institute, the University of Maryland, the Illinois Institute of Technology, and Hahnemann Medical College.

Another group of institutions has done or is doing research, supported by the CBW program, that is not classified; it includes the universities of Chicago, Minnesota, Michigan, and Texas, Ohio State University, and M.I.T.

Cooperation, including joint support of graduate students, seems particularly flourishing between Detrick and universities in the Washington area, such as the University of Maryland and George Washington University. GW had Detrick contracts totaling $1,202,000 in 1960, and from 1952 to 1959 it conducted a comprehensive research program relating to the "physical and biophysical factors incident to the explosive dissemination of biological aerosols." The annual report of the dean of sponsored research for 1959 reported "phenomenal success improving the efficiency of dissemination of liquids" and noted that, "While it is quite obvious that the end result . . . will be a new weapon," GW's role was limited to research and did not include development. GW maintained a special laboratory at Fort Detrick during that period. Similarly close relations appear to exist between the Dugway Proving Ground and academic institutions in its arsa. In 1960 the University of Utah had eight contracts with Dugway, totaling $1,570,000. Utah State University also has worked with Dugway.

Finally, it should be pointed out that many more institutions than those cited have contributed to the CBW program. While the Army has turned to academic organizations for basic research, especially on the biological side, industrial contributions to the chemical-weapons program have been substantial. At times nearly 65 percent of the military R&D money in CBW has gone to industry, which is reported to be the most productive source of new compounds. Arthur D. Little, Inc., and DuPont are among companies mentioned as prominent contributors to the CBW program. From outside the chemical industry, many aerospace companies now devote some fraction of their efforts to CBW.

BEYOND BASIC RESEARCH

During the past few years the Army and the Air Force together have moved into another area of CBW research. It goes by a lot of contemporary-sounding titles but boils down to evaluation of chemical and biological weapons and delivery systems. The controversial contracts at the University of Pennsylvania are of this type (see end of article). But, although Penn is a crucial cog in this phase of the CBW program, it is not the only one: New York University also is performing such studies, under an Air Force contract, and a Pentagon official recently stated that related studies are being conducted by, among other organizations, RAND, the Stanford Research Institute, and the Institute for Defense Analyses.

Research Anaylsis Corporation, a small firm located near Washington, in a brochure designed to reflect past support by government as well as to attract more, lists the following "research capabilities." Under the heading "Agricultural warfare" are "Study of biological and chemical attacks on crops and some analyses of effects on livestock," "Covert attack on a food crop," and "Impact of chemical attack on guerrilla food crops." Under "Guerrilla warfare and counter-insurgency" are "Evaluation of counter-insurgency requirements in Southeast Asia," and "Southeast Asia environmental-data collection." And under "CBR warfare" are "Military potential of GB" [a toxic nerve gas], "The feasibility of chemical warfare in defense of a perimeter in the Naktong Valley basin," and "The value of toxic chemicals in ground warfare."

Another leading entry in the field of CBW is the Travelers Research Center, an outgrowth of the Travelers Insurance Companies. Its most recent brochure reports studies of military operations that are "highly sensitive to the natural environment." Chief among these, the report continues, ". . . are chemical and biological weapons systems, which exhibit a high degree of dependence upon meteorological, terrain, and vegetative factors. The extensive experience of the TRC staff in research on turbulent diffusion and transport of atmospheric contaminants provides a firm base for TRC's participation in the nation's CB weapons analysis program. The Center's interest in this field stems not only from the importance of understanding the environmental phenomena involved, but also from our desire to support and assist the United States in acquiring effective, humane, incapacitating (non-lethal) systems for coping with proliferating limited war and counter-insurgency. One study was undertaken for the Army to identify the most effective approaches for contending with difficult military situations with a minimum loss of human life to both sides. Another study conducted for the Navy provided an updated review of the influence of micrometeorological factors on chemical warfare in the form of a technical manual to assist in the identification, observation, and prediction of relevant meteorological factor and processes. In another study for the Army, TRC began comprehensive research on dosage prediction techniques to provide up-to-date knowledge of dispersion processes in the lower atmosphere, and with a critical evaluation of present quantitative techniques for predicting the behavior of atmospheric contaminants. This study is similar in many respects to those being conducted on urban and regional air pollution."

Travelers has branched out in another new direction: "Because modern military planning must often consider technical and strategic goals in relation to their political, sociological and psychological implications, particularly with respect to limited war and counter-insurgency," the brochure states, "a study was undertaken for the Air Force to assess not only the military potential of nonlethal CB weaponry, but also the psychopolitical reaction to its use."

This is the chain of research. The United States government is developing chemical and biological weapons. It is learning how to use them effectively. And, finally, it is inquiring into the public reaction to their use.

ELINOR LANGER.

THE DETRICK RESEARCH PROGRAM

(Excerpts from Opportunities for Fundamental Research, a Detrick publication issued in connection with the NAS–NRC Detrick fellowship program)

AEROBIOLOGY

Respiratory Infections: . . . The disease process in laboratory animals exposed to aerosols of microorganisms is studied and characterized. Fundamental research is needed in the pathogenesis of disease in relation to (1) the particle size of the aerosol, (2) temperature and other environmental conditions, and (3) the effects of immunization on respiratory infectivity.

Environmental Stress: Basic research is needed in relation to the responses of airborne microorganisms to environmental stresses such as temperature, relative humidity, drying, and solar radiation. Quantitative data on the effects of these stresses are limited. In addition very little is known of the fundamental mechanisms which determine the resistance or susceptibility of cells to their environment. Studies are contemplated in which microorganisms will be exposed to natural sunlight, temperature and humidity ranges, etc., and wherein the effects produced may be measured quantitatively.

BIOCHEMISTRY

Biochemistry: Various fundamental aspects of the biochemistry of microorganisms and bacterial products are being investigated. Some current problems are concerned with (1) the site and mode of action and the identification of the structure of an inhibitor of mammalian oxidation produced by various species of microorganisms, (2) the identifica-

tion of the structural features of bacterial toxins required for biological activity including a study of reactive groups and the composition of partially degraded fragments, and (3) the effect of microorganisms on the metabolism of lymph tissue in vitro.

IMMUNOLOGY

Medical Entomology: This field involves basic research on the biology and rearing of medically important insects, the factors affecting infection of various arthropods and factors affecting transmission of micoorganisms. Current problems consist of basic studies of effects of rearing procedures for various insects on longevity and fecundity; the effects of different environmental factors on infection of insects and on virulence of microorganisms.

PLANT SCIENCES

Pathology: A broad research program on several plant diseases is in progress. Some areas currently under investigation include: Factors of environment (host plant and pathogen) which affect spore germination, germ tube penetration, establishment of infection, disease symptom expression, sporulation, viability retention, resistance to infection. These and other problems of interest extend into fields of irradiation biology, physiology and genetics.

Physiology: Excellent opportunities exist for research on growth regulators, herbicides, defoliants, and problems of absorption of chemicals. Basic research is needed on the uptake, translocation, mode of action, structure versus activity relationships, and the function of surfactant compounds in herbicidal formulations.

LANGER

UNIVERSITY OF PENNSYLVANIA: IT'S HARD TO KICK THE HABIT

The University of Pennsylvania is now in the second year of an increasingly bitter dispute over the presence of CBW research on its campus. The project at Penn involves applied research on weapons systems; it has been going on for about 10 years under various titles: most recently, "Summit" (an Army contract) and "Spicerack" (an Air Force project). The contracts total roughly $1 million a year.

The Summit contract calls for the researchers, among other things, to "prepare analyses and studies of the behavior, technical properties, and performance of particular agents, munitions, weapons components or subsystems of C&B weapons systems. The required analyses will be directed to include estimations of the human effects of particular C&B agents; characterization of the aerosol behavior of the specific agents in field clouds; appraisal of the performance of candidate munitions-agent combinations under environmental conditions; examination of various protective procedures in specific military situations; and the estimation of human factors and response to the C&B environment."

Penn subcontracted with the Cornell Aeronautical Laboratory for additional research on "targeting." Part of Cornell's job was to "conduct a detailed target analysis to determine anticipated target neutralization requirements. This analysis will consider (i) protective measures against which a weapon capability should be required; (ii) acceptable time to incapacitation requirements; and (iii) target sizes and content and minimum acceptable casualty infliction to achieve neutralization."

The relation between these projects and U.S. operations in Vietnam is a matter of some debate. University officials connected with the controversy have made many contradictory statements, sometimes conceding relevance to Vietnam, sometimes denying it. But the researchers have done a good deal of study of the application of CBW to a number of crops, including rice; of the effects of crop-destruction on the economies of underdeveloped countries and on the political and nonpolitical climate of Asia. In an interview with *Science* last fall, Knut Krieger, the chemistry professor who directs the research, said that he receives Army field reports from Vietnam and that he has evaluated tests on defoliants. Penn now has a capability with which the Pentagon, for immediate or long-range reasons, is reluctant to part. "We could get along without Penn," one official recently commented, "but we're not very anxious to try."

Summit and Spicerack carry with them some obvious liabilities. President Gaylord Harnwell says that Penn loses money on the contracts—about 5 percent of the cost of the projects or about $50,000 a year. The bookkeeping on such matters is extremely intricate, and on the basis of other universities' experiences it is safe to say that profit and loss can be calculated in a great many different ways. However, the university is plainly not reaping great financial rewards from CBW, and officials state there is no hidden funding from which they are benefiting. The CBW projects have given the university painfully bad publicity. And, finally, the controversy has aroused and divided faculty, students, administrators, and alumni.

The answer to the question why, in this troubled climate, the research has not simply been abolished has to do in part with internal politics of the university, in part with the fact that the controversy touches on some of the most sensitive issues in academia. Last year a small group of professors sought to have the CBW projects thrown out because they considered its subject matter immoral. A much larger number of faculty members were unwilling to set a precedent of vetoing the substance of a colleague's research; instead they took up the issue of publishability. The faculty passed a resolution reaffirming an old but, practically speaking, extinct university policy that called for accepting "contracts or grants only for research projects whose principal purpose is to produce results which will be freely available and freely publishable in the ordinary manner of open research in the relevant discipline." The faculty also set about devising a mechanism which would assure review by the faculty of contracts suspected of violating the criteria.

The publishability issue did not prove an effective vehicle for accomplishing the faculty's object of ending CBW. President Harnwell believed that, under a special dispensation negotiated into the Spicerack contract at renewal time last spring, Krieger was technically free to publish his findings and that the research therefore did not come under the terms of the faculty resolution. Accordingly, he renewed the contract. The difficulty is that Krieger does not want to publish. "My findings are not of general interest," he told *Science*, "they are highly specialized. And in the second place I don't think it's the kind of work that ought to be published. It's a matter of national security."

Harnwell adds another argument to Krieger's. "He's a tenured professor," the President remarked to *Science*. "How can we make him publish if he doesn't want to? It's really a question of academic freedom. If I told someone what research to do or not to do or what and when to publish, another portion of the faculty would be down here knocking at the doors."

Harnwell's attitude—that what is at stake is neither the substance of the research, nor its publishability, but academic freedom—has been echoed this year by a faculty group that was relatively silent earlier, a group centered in the engineering sectors of the university. This group, heavily involved in defense contracting, feels that the ban on classified research, endorsed by most of the faculty, would harm the engineering schools. University officials have also been hearing from alumni, some of whom are reportedly shocked that the propriety of the University's conducting research related to national defense should even be called into question.

At this point, the future of Spicerack and Summit is uncertain. President Harnwell recently indicated that he would like to get rid of the research because he is tired of the emotion-racked controversy. But the University cannot simply run out on the Pentagon, and one problem is where to ship the research. The University is contemplating, among other possibilities, transferring it to the University City Science Center, a new, nonprofit, R&D corporation in Philadelphia, owned by a consortium of Pennsylvania colleges and universities. The trouble is that the consortium includes Quaker colleges Haverford and Swarthmore; there have been reports that they don't want CBW either.

E.L.

[From Science, Jan. 20, 1967]

CHEMICAL AND BIOLOGICAL WARFARE: THE WEAPONS AND THE POLICIES—II

(By Elinor Langer)

"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

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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 dessicants; 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 Russian 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."

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. Reseach 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.

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 sre no authenticated instances of modern use of biological weapons.

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 anticivilian 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."

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 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 long-standing 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.

[From Science, Jan. 20, 1967] LANGER

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 antipersonnel 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 antiercp 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

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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 herbicidss 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, Salavdor 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.

LAND, WATER, AND PEOPLE

HON. WM. J. RANDALL

OF MISSOURI

IN THE HOUSE OF REPRESENTATIVES

Thursday, March 6, 1969

Mr. RANDALL. Mr. Speaker, it was my privilege to be present at the annual meeting of the Cass County, Mo., Soil and Water Conservation District at Pleasant Hill, Mo., on Thursday evening, February 20.

At that time, John E. Fichter, Assistant State Resources Conservationist, from the State Office of the Soil Conservation District, U.S. Department of Agriculture, Columbia, Mo., made the principal address of the evening, entitled, "Land, Water, and People." After the meeting I requested a copy of his remarks in order that I might share his thoughts with the readers of the CONGRESSIONAL RECORD. He was good enough to mail a manuscript which I recently received.

The annual meeting at Pleasant Hill provided a pleasant and most interesting evening because it was the occasion of the annual poster contest. One hundred and forty-eight students, representing nine schools, each had a poster on display. These were judged by a committee headed by the superintendent of schools. The results were announced and the prizes awarded the winners. It was a thrill to see the expressions on the faces of the young people when their names were called as winners. Moreover, it was a refreshing experience to see how well these young people had done to demonstrate their understanding of resource use and development. The theme of the contest was "Conservation in Action."

It was an enjoyable evening, yet it was also a productive meeting because it provided the opportunity to review the activities and accomplishments of the soil conservation district for the past year. Mr. Fichter's remarks follow:

LAND, WATER, AND PEOPLE

(Address by John E. Fichter, Pleasant Hill, Mo., Feb. 20, 1969)

Mr. Chairman, distinguished guests, ladies, gentlemen and students, and especially you students.

I give you my compliments and congratulations; your 148 posters representing the nine schools in your Soil and Water Conservation District displayed here tonight makes a living testimony, demonstrating that true understanding of resource use, development and conservation does exist in Cass county, Missouri. To me this is truly "Conservation Education in Action."

All of you are having fun and enjoying yourselves tonight. It is good—good to have a time to review activities and accomplishments of the past year.

I assure you that the Soil Conservation Service considers this an important meeting. On that note, I bring you greetings from our State Conservationist, Mr. Howard C. Jackson, who tonight is at the Harrison County Soil and Water Conservation District annual meeting for their 25th anniversary. Harrison County was the first Soil and Water Conservation District organized in Missouri. Tomorrow night he will help the Daviess District folks celebrate their 25th anniversary.

Before this year is over, 12 more Missouri Conservation Districts will each celebrate a milestone observance of 25 years of service, protection and improvement in each of their communities.

SELF GOVERNMENT—MOVING AHEAD—USING POSITIVE ACTION

It is a real pleasure for me to be here with you this evening. I look forward to opportunities such as this to get better acquainted with the men and women who work on the front line using, securing and developing our land and water resources. You represent the real strength of the Conservation District movement.

What I have to say deals with the job that District folks work at day in and day out. The job of getting technology into action on your land, and in your community.

Our work with and through each individual Soil and Water Conservation District makes it essential that we do have a close working relationship.

There is a personal satisfaction in associating with you dedicated people who devote so much of your time and energy to District work. We have a big job ahead of us, to make our land and water resources support our fast growing nation and maintain our high standard of living. This is an enormous challenge.

HEAVY DEMAND ON RESOURCES

Our land and water resources are being leaned on very heavily today. What will the demand be next year and the year after that? We will have no more land or water than we have today. Next year the United States will have 2.6 million more people than today. That's six times the population of Vermont. By 1975 we can expect a population of 230 million. By the turn of the century we will have 340 million people, a 100 to 110 million increase, up 50% from today and that is only 31 years from now.

A tremendous job of resource conservation and development is being done, it is true. However, we continue to:

1. Lose the equivalent of 400,000 good acres of land each year from erosion and misuse.

2. Spend billions each year to repair flood damages—when many of them are preventable.

3. Put up with almost 80 million dollars of damage each year in upstream sediment damage, 70% of which is preventable if land treatment measures are installed everywhere they are needed.

GOOD OLD DAYS

I suppose there exists in all of us a bit of nostalgia for the "Good old days", but this has always been a relative thing. The "Good old days" of my grandfather, my father, myself and my son are separate and distinct eras. But they can serve a good purpose even today. The past can teach us a vital lesson.

THE BEGINNING

Five billion years ago the planet Earth was formed (through Divine Province) from a cloud of dust. Between then and now life took place. Our continent teemed with creatures now extinct or altered, giving position to the highly advanced man in the high order that we know today. This life of remote ages is written in fossil remains and imprints obscured by the sands of time.

The settlers were not the first to establish an advanced culture on Western land. In the year 1 A.D., Indians farmed the lands, now bounded by the State of Colorado. For 1,300 years, they enjoyed an advanced civilization. Their story is written in Mesa Verde National Park.

What interrupted this advanced Indian civilization? The answer is the failure to pay attention to the basics—land and water resources.

OTHER CIVILIZATIONS

Let's look elsewhere in the world. It is not by coincidence that man's first cities were built along the banks of the Tigris and Euphrates Rivers in Mesopotamia, and along the rich soil of the Nile.

Some 3,000 years ago, Babylon was a fertile, productive land. But the kings following Nebuchadnezzar let their soil and water resources be exploited and abused. Land once described as "flowing with milk and honey" became unable to support human life.

North Africa, once the granary of Rome, neglected its land, lost its water and became part of the desert. Its inhabitants in effect turning into ghosts of human history.

AMERICA

History does prove that any nation that neglects its soil and water resources will die. America, a comparatively young nation, is no exception. Many once fertile areas of the United States are so eroded that productivity is either gone or greatly reduced. A 10-year-old survey shows 500 million crop acres, 120 million acres almost useless.

himself with a poise that won plaudits for "the new Nixon."

This isn't a "new Nixon," this is an "old pro."

Old friends recognize it, even if new friends are surprised.

An eminent Swiss colleague, Drago Arsenijevic, of the Tribune de Geneve, in Geneva, listened to Mr. Nixon at a Republican dinner in Arlington last June and reported that "Nixon's success is indisputable."

After only one month in the White House it gradually becomes evident that Mr. Nixon has brought a new dimension to the presidency.

I would call it "expertise."

One already senses a sure touch, a dexterity, that marks the top executive of a large organization who has made his way through the ranks and has learned the business.

He is, without any doubt, the best prepared man to enter the White House since World War II.

His opposition is already worried.

"There is a dark suspicion growing among Democrats that Richard Nixon stole off to charm school in his years out of power and he may in 1972 look too strong . . ." writes Mary McGrory in the Washington Evening Star.

The President's expertise will no doubt be tested. His meeting with high caliber political figures during his trip to Europe provide an early yardstick.

But the free world is hungry for a competent spokesman and leader. No one is equipped like a President of the United States.

The way is open, and Mr. Nixon looks like just the man for the job.

TWO MARINE CORPORALS KILLED IN VIETNAM

HON. CLARENCE D. LONG

OF MARYLAND

IN THE HOUSE OF REPRESENTATIVES

Monday, March 10, 1969

Mr. LONG of Maryland. Mr. Speaker, Cpl. Billy H. Best and Cpl. Paul A. Cumberland, two fine young men from Maryland, were killed recently in Vietnam. I wish to commend their courage and honor their memory by including the following article in the RECORD:

CITY, COLLEGE PARK MARINES ARE KILLED IN VIET FIGHTING

Two Marine corporals, one from Baltimore and the other from College Park, have been killed in action in Vietnam, the Defense Department announced yesterday.

They were:

Cpl. Billy H. Best, 18, of Baltimore, who was killed Monday near the An Hoa combat base in Quang Nam province by enemy small-arms fire while on patrol.

Cpl. Paul A. Cumberland, 19, of College Park, a squad leader in the 3d Battalion, 26th Marine Division who was killed February 27 by enemy fire while on a search-and-clear mission in An Hoa, Quang Nam Province.

Corporal Best, who was born in Wilson, N.C., had lived in Baltimore since he was 12 years old.

He attended Calverton Junior High School and was in the Job Corps for several months before he enlisted in the Marines in August. Corporal Best arrived in Vietnam three weeks before he was killed.

Corporal Best is survived by his mother, Mrs. Minnie Ruffin, his stepfather, Chester Ruffin, and a brother, Kenneth Earl Best, all of Baltimore.

Corporal Cumberland attended parochial school in College Park and was graduated from St. Anthony's High School in Washington in 1967. He was a member of the College Park Boys' Club.

After graduation, Corporal Cumberland was a storekeeper in the Capitol Building for the Chesapeake and Potomac Telephone Company.

Corporal Cumberland enlisted in the Marines in January, 1968, and had been in Vietnam since July.

He is survived by his parents, Mr. and Mrs. Francis D. Cumberland of College Park; two sisters, Mary and Nancy Cumberland, and five brothers, Daniel F., Matthew T., Stephen W., Jeffrey P. and Francis D. Cumberland, Jr., all of College Park.

TRIBUTE TO LAWSON B. KNOTT

HON. J. J. PICKLE

OF TEXAS

IN THE HOUSE OF REPRESENTATIVES

Monday, March 10, 1969

Mr. PICKLE. Mr. Speaker, after nearly 34 years of Federal service, one of the most capable men in Washington has retired. Lawson B. Knott, the sometimes unsung but always untiring Administrator, will be missed by his friends. I sure know that I will miss his rapt attention to duty, his efficient manner, and his warmth.

Lawson is a professional with the human touch. He has to be. As Administrator for GSA, he directed the activities of 39,000 employees. The scope of his agency stretched across the Nation. His wide range of responsibilities included construction and daily operation of thousands of Federal buildings, procurement and distribution of common-use supplies, drafting procurement regulations, operation of the National Archives and Federal records centers, use and disposal of surplus property, management of stockpiles of strategic and critical materials for use in national emergencies, and transportation and communications management. He guarded and dispersed a budget that ran into the billions of dollars.

This native son of North Carolina was well backgrounded and extremely well qualified for this high position that he earned. A graduate of Duke University, he came to GSA from the Department of Defense in 1956, after 21 years of Federal service in various legal and administrative positions relating to property management.

From 1959 until he was appointed Deputy Administrator of GSA, Mr. Knott served as Deputy Commissioner, Public Buildings Service. Former GSA Administrator Boutin resigned in 1964, and Lawson Knott was the logical man to serve as Acting Administrator until President Johnson made it official by appointing him Administrator in 1965.

Mr. Knott and his wife live in Arlington. He has promised her a leisurely vacation. She, too, has earned one.

I wish to thank the both of them for services to the people of this great Nation. I wish them well in their next adventure. And there will be one; Lawson is yet a young man to have compiled such outstanding credentials. I await anxiously to learn what the future holds for him.

Mr. Speaker, Lawson Knott is able, as attested to by his own record. But he is more than that, Mr. Speaker. He has the quality of integrity that a public servant must have, and Lawson Knott has it in abundance. And even more, he has great loyalty—loyalty to friends who have seen him tested and proven, and loyalty to his job and country. As one Congressman I want to express my personal appreciation of his loyalty to our beloved former President Lyndon Johnson, and to tell him again that we in Texas will always remember with affection the help and friendship of Lawson Knott.

SILENT WEAPONS

HON. ROBERT L. F. SIKES

OF FLORIDA

IN THE HOUSE OF REPRESENTATIVES

Monday, March 10, 1969

Mr. SIKES. Mr. Speaker, the reawakening of controversy about the place and the need for chemical and biological weapons in defense tends to obscure the significance of the contributions made to the Allied cause by chemical weapons during the current conflict. These contributions, which should be the subject of much wider interest than has been shown, are set forth in the Army Digest for November 1968 in an article titled "Silent Weapons," I submit it for reprinting in the CONGRESSIONAL RECORD:

SILENT WEAPONS

They don't kill or even wound. They weren't intended for battlefield use. Yet today they are emerging as a major new development in combat support in Vietnam.

What are these agents?

One is the newly battle tested (but far from newly developed) riot control powder known as CS—an agent much more effective and much less dangerous than the older CN type. The other is the use of chemical defoliants to deprive the Viet Cong of cover for ambushes and covert movement of their troops and supplies.

CS is not a gas. Neither is it a toxic chemical agent under the standard definition. It is a white crystalline powder which in finely ground form is disseminated by mechanical dispensers or explosive grenades, or in coarser form by burning type grenades.

Effects of CS on humans are pronounced and instantaneous—coughing, severe burning of the eyes, tightness of the chest, acute discomfort.

These effects are very much the same as CN which has long been used by civil law enforcement agencies in riot control situations. But CS acts much faster, and has been proven extremely safe. It is temporarily disabling but nonlethal. Those exposed to it quickly lose their aggressiveness and seek only to reach fresh air quickly, where the effects disappear within 10 to 15 minutes, with no after effects.

CS compound takes its name from two American chemists, B. B. Corson and R. W. Stoughton, who first reported its preparation in 1928. The British further developed the compound and compiled data on its potentialities in riot control. For the scientifically-minded, it is known as ortho-chlorobenzalmalononitrile.

Because it is so effective and fast acting, some people believe that CS must therefore

be more dangerous than CN. Actually, CS is much less toxic.

In the many tests using troop volunteers and in actual riots and battle, there has never been a fatality attributed to CS.

USE IN VIETNAM

As a newcomer to the battlefield in Vietnam, CS initially encountered considerable skepticism as to its effectiveness in combat support. This, coupled with unfamiliarity with its use and absence of proven field techniques, posed problems. But these were swiftly overcome as experience was gained. New uses and novel methods of disseminating the agent have rapidly developed. Commanders now find it a valuable weapon in combat situations when it is apparent that explosives are not the sole or best answer.

Viet Cong have frequently forced women and children to accompany them as hostages; they do not hesitate to use them as protective shields against anyone seeking to clear their tunnel hideouts.

In such situations, CS quickly proved its value. Labyrinthine tunnels no longer guarantee snug sanctuary to VC snipers. At first, explosive grenades were simply tossed into tunnel openings. These proved ineffective, since some tunnels consist of as many as six levels, covering extensive areas.

A handy solution to the problem was a small, commercially produced blower known as Mity Mite, often used on farms to dispense insecticides. CS grenades are set off in the tunnel opening and the powder-like substance—very much like the talcum powder that is used in training to simulate the real thing—is forced in by blower.

In one reported operation, 17 Viet Cong and some 400 non-combatants being held as hostages were forced from a tunnel complex by CS, with nobody wounded on either side. Again, 43 armed Viet Cong were captured with no friendly losses and one enemy killed when he tried to break away.

CS quickly forces those hidden in caves or tunnels to find their way to fresh air. If civilians emerge, they are escorted to VC suspect enclosures. If military emerge without firing, they are captured swiftly. Reports from Vietnam state that greatly increased intelligence, plus more cooperation from both noncombatants and prisoners, have resulted. Lives are frequently saved on both sides.

DELIVERY METHODS

When more tunnels are located than can be destroyed quickly, CS is used to deny use of the complex until supporting engineer troops can be brought up to destroy it efficiently. Often, smoke is forced into the tunnel to locate all exists. After an airing, the complex is inspected for intelligence information. Then CS powder is blown into the tunnel.

CS also can be forced in by connecting bags of the powder to an explosive charge, which renders the tunnel uninhabitable for at least a week and a waterproofed CS gives promise of extending this to several weeks. In routing the dug-in enemy, infantrymen usually lob in a CS grenade, then toss in a fragmentation grenade after the first one has exploded. This dispenses a cloud of CS into the tunnel.

CS has proved extremely effective when delivered by helicopter onto a suspected enemy area. VC scamper out, even from well camouflaged locations, gasping and seeking fresh air. As a result, U.S. forces often are able to move into large areas totally unopposed.

Dispensing the powder by helicopter effectively clears a village quickly. Inhabitants running for fresh air don't have time to hide weapons and munitions. Reports from Vietnam credit the agent with saving lives in reconnoitering villages—and it also works very well in discouraging sniper fire.

Usually psywar leaflets and loudspeakers are used to warn villagers that CS will be used if sniping persists. In one case, sniping stopped in the entire surrounding area as well as in the village under surveillance.

In one major operation the 1st Cavalry Division used CS to flush VC from fortifications, suppress automatic weapon fire and put down preparatory fires on an objective area and a whole village. Eighty VC suspects were taken with virtually no resistance.

TACTICAL USE

As part of their field tactics, the VC often move in close to U.S. troops in order to escape air and artillery attack. The tear agent is coming into wide use lately to force them to break contact.

In one operation, helicopters dropped CS grenades to blanket a small patch of jungle believed to be a fortified VC headquarters. After the area was blanketed with CS, airmobile troops with protective masks were set down by helicopter and took over the area with almost no resistance.

Another use of the agent is in perimeter defense of fixed installations. CS booby traps are placed around the area, to be exploded by unwary VC trying to penetrate the defense. Sometimes an even simpler method is used—powdered CS is simply sprayed on foliage along trails.

Coughing, gasping enemy infiltrators are located easily as they seek to retreat.

Patrols operating some distance from friendly lines spray CS behind them to prevent ambush patrols from following them down a trail. In one reported instance, a CS grenade tossed down the path gave the patrol time to set up a counter ambush.

In still another application in Vietnam, CS is disseminated preceding attack on strongly fortified positions. Entrenched areas that had successfully resisted both aerial and artillery fire have been reduced in an hour or two by combining the use of CS with maneuver and firepower.

BEER CANS AND BASEBALLS

Several methods are used to disseminate the tear agent. One type of grenade bursts. Another burns. The burning grenade (M7) resembles the ordinary 12-ounce beer can. It weighs about a pound, is armed with a quick burning fuse—one to two seconds—and the contents burn for up to 35 seconds. An alternative fuse is available to give it an 8 to 10 second delay. The grenade can be fired from a grenade launcher-equipped rifle, or from a grenade projector.

The baseball-size grenade (M25) is three inches in diameter, bursts within two to three seconds after the pin is pulled. It weighs about eight ounces. Its short fuse discourages the enemy from tossing it back. That same short fuse means that a grenadier can toss it high to explode in midair over a suspect area.

The Army also has dispersers designed to spray a finely-powdered form on a target larger than can be covered by several grenades. One can be man-carried, while another type is designed for mounting on vehicles or aircraft for large area coverage. Additional types of dispersers and munitions, including cluster munitions for delivery from helicopters, have been developed.

HERBICIDES SERVE TOO

Along with the use of the tear agent against the enemy in Vietnam, some chemicals currently in wide use on farms or lawns in the United States are being taken to war. These herbicides or common weed killers are the same chemical compounds that are on sale in this country at your corner grocer, hardware or agricultural support house.

Dense jungle, which is home to the Viet Cong, provides the enemy with effective ambush cover. Wooded areas along trails, roads, railroads, canals and power-lines have been a happy hunting ground for VC units until U.S. Air Force transport planes began to spread their loads of defoliating chemicals. The planes have been flying at such l levels that many are pock-marked with r metal patches—signs of bullets throu wings and bodies.

Defoliants assist our forces in gather intelligence by permitting a view below jungle canopy for analysis of trail activi storage site locations, and targeting. moval of overhanding foliage exposes ground area to intensive photographic s veillance and direct fire.

It is obvious, of course, that neither riot control agents nor the herbicides al can be expected to win a war. But as added silent weapon in the Army's arse they are helping to win battles, and achieve military objectives.

RESOLUTION BY GOVERNORS CO MENDING PRESIDENT NIXON

HON. GLENARD P. LIPSCOMB

OF CALIFORNIA

IN THE HOUSE OF REPRESENTATIVE

Monday, March 10, 1969

Mr. LIPSCOMB. Mr. Speaker, un leave to extend my remarks I submit inclusion in the RECORD a resolution co mending President Nixon which unanimously adopted at the recent N tional Governors' Conference.

The resolution, proposed by Gover Reagan of California, praises Presid Nixon for his recognition of the vital r of State and local government in prov ing public service to our Nation's citiz and urges continuation of this spirit cooperation throughout the Federal G ernment. It expresses the resolve of Governors to work to help assure highest degree of intergovernmental operation.

Strengthening cooperation between Federal, State, and local government important to preserving freedom good government in our great Nation. I am sure the resolution approved at Governors' Conference will be of inte to the Congress and the public. The follows:

Whereas President Richard M. Nixon from the start of his Administration re nized the vital role of state and local gov ment in providing responsive and effec public service to the citizens of our nat and

Whereas the President has specifically ignated a former governor, Vice Presi Spiro T. Agnew, to provide top level lea ship in maintaining liaison between s and Federal government; and

Whereas the Office of Intergovernme Relations has been established under the rection of former governor Nils Boe to cilitate communication and cooperation tween all units of government at all le and

Whereas the President has directed e element of the Federal government to closely with state and local government improve coordination and to develop the possible cooperative relationships to e tively serve all the people and to solve many problems facing public offi throughout the nation; and

Whereas the confidence of the Presi in the leaders of state and local governm has been reflected in the appointment the Cabinet and to other high posit throughout the Executive Branch of Federal government:

Now, therefore, be it Resolved that the tional Governors' Conference expresses