Director of
Central
Intelligence

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Use of Toxins and Other Lethal Chemicals in Southeast Asia and Afghanistan

Special National Intelligence Estimate
Volume II—Supporting Analysis

CIA HISTORICAL REVIEW PROGRAM
RELEASE AS SANITIZED

Top Secret

SNIE 11/50/37-82JX
[illegible] 1060-82 [illegible]
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USE OF TOXINS AND OTHER LETHAL CHEMICALS IN SOUTHEAST ASIA AND AFGHANISTAN

Volume II—Supporting Analysis

The National Foreign Intelligence Board
approved publication of this Estimate
on 2 February 1982.
Information available as of 26 February 1982
was used in the preparation of this second volume.

THIS ESTIMATE IS ISSUED BY THE DIRECTOR OF CENTRAL INTELLIGENCE.

THE NATIONAL FOREIGN INTELLIGENCE BOARD CONCURS.

The following intelligence organizations participated in the preparation of the Estimate:

The Central Intelligence Agency, the Defense Intelligence Agency, the National Security Agency, and the intelligence organization of the Department of State.

Also Participating:

The Assistant Chief of Staff for Intelligence, Department of the Army

The Director of Naval Intelligence, Department of the Navy

The Assistant Chief of Staff, Intelligence, Department of the Air Force

The Director of Intelligence, Headquarters, Marine Corps

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I. CHEMICAL WARFARE IN LAOS

Key Judgment: Lao and Vietnamese forces, assisted by Soviet logistics and supervision, have used lethal chemical agents against H'Mong resistance forces and villages, causing thousands of deaths since at least 1976. Trichothecene toxins have been positively identified as one of the classes of agents used, but medical symptoms indicate that irritants, incapacitants, and nerve agents also have been employed.

Nature of the Evidence

1. Since 1976 a total of 261 chemical attacks against H'Mong villages and guerrilla strongholds in Laos have been reported by victims and witnesses. These attacks reportedly caused the deaths of at least 6,504 of the H'Mong people.[1] Most of the reports were provided by H'Mong refugees, including village leaders, who were interviewed in Thailand and the United States. These more than 200 interviews were carried out variously by US Embassy officials in Thailand, a Department of Defense team of medical-toxicological experts,[2] US physicians (including a forensic medicine specialist), Thai officials, journalists, and representatives of international organizations. According to these interviews, US L-19 and T-41 aircraft—captured during the US-Vietnamese conflict—and Soviet AN-2 aircraft were usually employed to disseminate toxic chemical agents by sprays, rockets, and bombs. In some cases, Soviet helicopters and jet aircraft were said to have been used.

2. The medical symptoms reportedly produced by the chemical agents are varied. According to knowledgeable physicians, the symptoms clearly point to at least three types of chemical agents: incapacitant/riot control agents, nerve agent(s), and one or more agents causing massive hemorrhaging. The last-named were positively identified as trichothecene toxins in the fall of 1981.

3. Important testimony was also provided by Laotian and Vietnamese defectors. A number of governments provided information based on their own collection efforts. Information provided by these sources includes the following:

- A special Laotian Air Force unit was responsible for carrying out attacks using chemical warfare (CW) rockets.
- CW agents were stored at sites in Laos.
- Warheads containing lethal agents were fitted to US rockets in several small laboratories in Laos.
- A nerve agent was used.
- Laotian and Vietnamese forces exterminated some H'Mong people by herding them into a cave, closing the entrance, and filling the cave with a lethal chemical gas.
- The Soviets were involved in an advisory and supply role.

4. confirmed the presence, transportation, and use of chemical warfare agents in Laos. The existence there of CW storage facilities was first noted on 14 February 1979, when the LPLA headquarters at Vientiane made preparations for Soviet personnel to inspect a chemical facility at Pakxe, where lethal chemical agents were stored. Other reports indicate that sites used for this storage of chemical agents or munitions exist at Savannakhet, Xiangkhoang, Vieng Sai, and Xeno. Chemical agents and munitions are moved by truck and aircraft between storage sites and airfields for loading on aircraft used in mounting chemical assaults.

5. typical conventional ammunition storage facilities, which are also used to store chemical munitions, are located near Pakxe, Xiangkhoang, and Vientiane.

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[1] See annex A.

[2] See annex C.

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6. Soviet AN-2 aircraft and captured US L-19, T-41, and T-28 aircraft. These have been the most commonly identified chemical assault aircraft in Laos.

7. ***Sample Collection and Analysis.*** In October 1979 a program was initiated to collect and analyze environmental samples that might contain residue from a chemical attack and tissue samples from H'Mong refugees reportedly exposed to toxic chemicals.[3] Environmental samples received from areas of chemical attack include: a piece of polyethylene plastic believed to have been contaminated with a vesicant and six samples containing a yellowish powder residue recovered from rocks, leaves, and roof thatching.

8. Analysis failed to reveal the presence of a vesicant or any known CW agent on the plastic sample. The powder residue samples were analyzed for indication of any known standard CW agents. None were detected in these samples. Two of the samples, however, contained diacetoxyscirpenol (DAS), a potent toxin of the trichothecene group, which causes massive hemorrhaging and death. One of these also contained T-2 toxin.[4]

9. ***Medical Examinations.***[5] A continuing problem has been the compilation of medical records and clinical histories on victims exposed to chemical attacks. This has been especially true in the camps through which H'Mong refugees are staged before resettlement to other countries. At least three, probably more, physicians who have been camp medical directors report that numerous refugees did show signs of continued gastrointestinal hemorrhaging, small blisters, and respiratory signs not associated with known pulmonary diseases even after exhaustive diagnostic tests. All these individuals reported involvement in at least one direct chemical attack of "yellow rain," and several of them were near death. These reports cover primarily the period 1978 through mid-1980.

10. Since the relief organizations in the camps do not routinely maintain medical records on patients, preferring to run simple outpatient centers, the medical data were collected by the camp medical directors or nurses and maintained separately in clinic files. In all cases, the files mysteriously vanished shortly before visits by official interviewers, most recently prior to the visits of the UN group of experts investigating CW use.

The Evidence

11. Vietnamese and Laotian chemical attacks against the H'Mong villages in northern Laos date back at least to 1976, when refugees first reported such attacks to officials in the Thai camps. (See figure 5.) Other than refugee reports, however, very little evidence on chemical attacks appears to have been compiled between 1976 and early 1979. From 1979 on, a much wider range of information broadly supporting the H'Mong allegations was obtained.

12. *Lao Pilot's Testimony.* The most complete description of the period 1976-78 came from a Lao pilot who was directly involved in chemical warfare. The pilot, a former LPLA officer who defected in 1979, reported that he flew L-19 and T-41 aircraft equipped to dispense toxic chemical agents on H'Mong villagers in the Phou Bia area of northern Laos. He said that the LPLA, in cooperation with the PAVN, had conducted CW operations in Laos since April or early May 1976. At that time, two LPLA H-34 helicopters were flown between Long Tieng and the Phongsavan airfield (near Xiangkhoang), both in Xiangkhoang Province, on a series of flights to transport rockets to Phongsavan for storage.

13. Between June and August 1976 the LPLA launched attacks in the area of Bouamlong—in Xiangkhoang Province—that was a stronghold for remnants of the forces of former H'Mong General Vang Pao. The LPLA used L-19 aircraft for CW rocket attacks aimed at eliminating the H'Mong resistance in that area. LPLA crews responsible for loading

[3] See annex B, table B-1, for a tabulation of samples collected and analyzed.

[4] See annex D.

[5] See annex E.

rockets on the attack aircraft noted, however, that they were not allowed to use the rockets that had been moved from Long Tieng to Phongsavan, even though Phongsavan was much closer to the Bouamlong target area than Long Tieng, where LPLA aircraft had to rearm. The pilot said that during nearly three months of flying missions against the Bouamlong area, he flew his L-19 aircraft to Long Tieng to be armed with rockets.

14. In late 1976 the pilot's L-19 aircraft was re-armed with rockets stored at Phongsavan. Initially, H-34 helicopters were used to transport the rockets from Phongsavan to a depot near the Ban Xon airfield, Vientiane Province, where they were fitted onto racks of the L-19 aircraft for missions in the Phou Bia area. Later, the rockets from Phongsavan were transported to Ban Xon by trucks. All US-manufactured rockets were stored with the tip and canister kept apart; in other words, the two parts had to be joined before being fitted to the racks on the aircraft. The pilot observed, however, that all the rockets transported from Phongsavan to Ban Xon were already assembled.

15. As part of his routine flight activities, the pilot would check over his aircraft and, in doing so, examine the tip portion of new smoke rockets that had been transported from Phongsavan. He said that most of them appeared "loose" in the portion where the tip and canister joined, whereas the tip and canister of the ordinary explosive-type rockets at Long Tieng were noticeably more tightly connected.

16. In late 1976, in preparation for airstrikes on Kasy (Louangphrabang Province) and in new areas of Phou Bia, the pilot said he began carrying two or three PAVN staff officers, sometimes accompanied by an LPLA staff officer, in T-41 aircraft for reconnaissance over the target areas. When these airstrikes were launched, the defector pilot initially flew his L-19 aircraft on missions with another pilot and an LPLA staff officer sitting in the rear seat. After two or three weeks, however, PAVN staff officers, who spoke excellent Lao, began alternating in the rear-seat role with the LPLA officers. Before each mission, the PAVN or LPLA staff officer would go over target areas outlined on situation maps—which then were taken along—and would point out the targets to be attacked. The source noted that at no time did the PAVN staff officer sitting in the back seat of his aircraft communicate with LPLA officers on the ground, as did the LPLA staff officers. A new PAVN officer was used on each mission of the T-41 reconnaissance and L-19 airstrike missions in the H'Mong areas. The average age of these PAVN staff officers was in the middle forties.

17. The source related that before flying L-19 airstrike missions with a full load of rockets he was often warned by an LPLA commander to fly at above-normal altitudes when firing rockets to preclude hazard to the occupants of the aircraft. For this reason the pilot surmised that the "smoke" rockets fired at the H'Mong people were unusual. He was able to observe that the "smoke" rockets detonated in the air and that some produced white smoke with a mixture of blue, while others produced red smoke with a mixture of yellow. The ordinary, explosive-type rockets detonated on impact. The commander or his designated representative told the pilot before every mission that the operations—called Extinct Destruction Operations—were intended to "wipe out" the reactionary H'Mong people.

18. Before a mission involving "smoke rockets," the commander warned the pilots to keep the operation secret. The source said that, during the nearly two years in which he flew rocket missions, he learned from the LPLA staff officers accompanying him that there were two types of rockets. The first, mostly "smoke" rockets, were to be fired at targets far away from LPLA and PAVN troops to avoid exposing them to the poison smoke. The second was of the ordinary explosive type, considered a "close support" rocket that could be fired near LPLA and/or PAVN troop positions. Initially, the L-19 aircraft carried eight rockets—five "close support" and three "smoke" rockets. Later, only four rockets, mainly of the "smoke" type, were carried.

19. After each mission in which chemical warfare rockets were used, the pilot was returned to a "rest house" at Phongsavan, where an LPLA doctor and nurse would examine him. He said that after his missions, especially in 1978, he was particularly well treated by the examining doctor and watched very closely by the LPLA nurse. Those L-19 aircraft pilots

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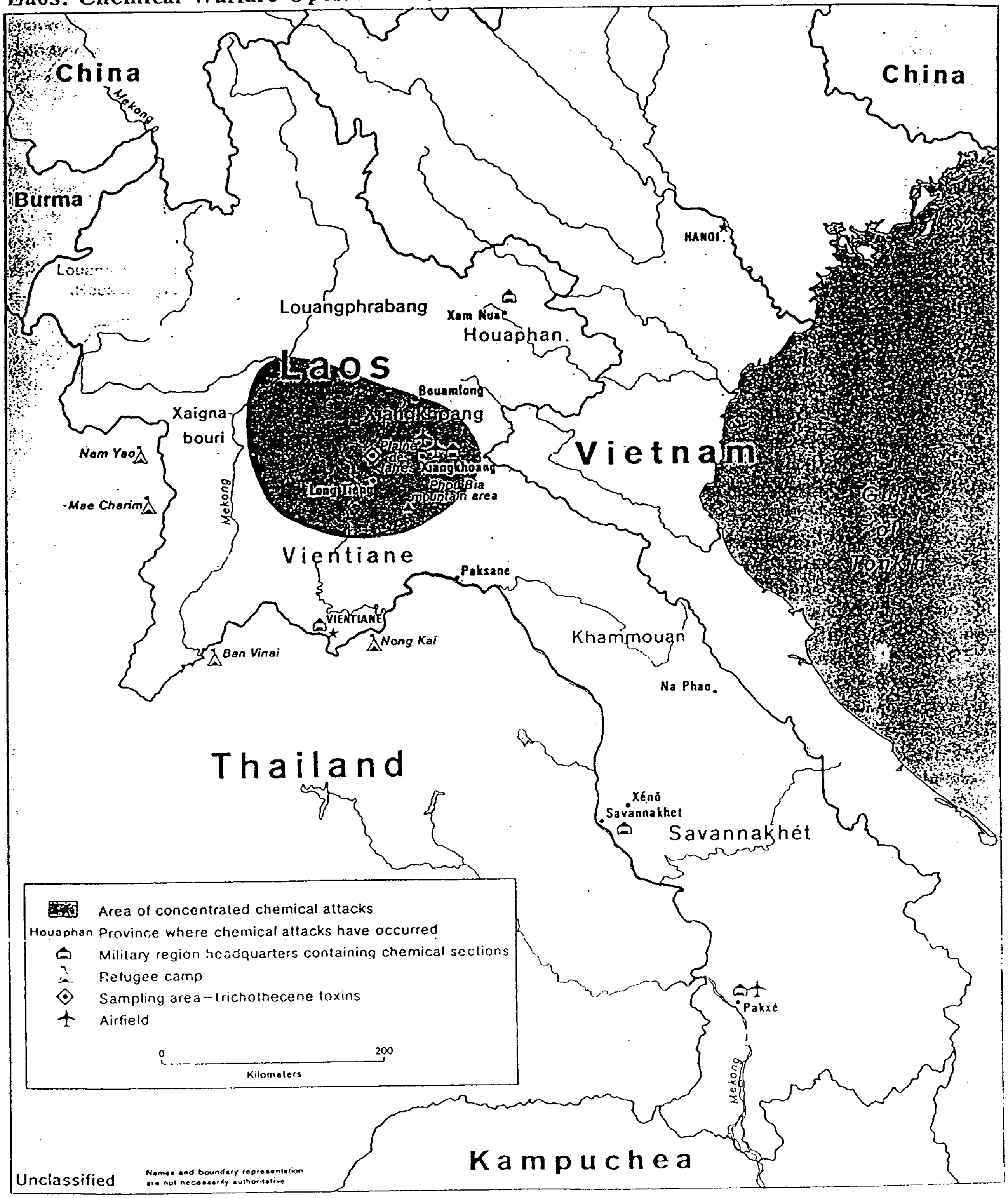
Figure 5
Laos: Chemical Warfare Operational Areas



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assigned to missions utilizing chemical warfare rockets had special privileges, including additional flight pay and free meals at the Phongsavan cafeteria. In October 1978 the LPLA stopped using L-19 aircraft on combat missions and began using Soviet MIG-21s for chemical attacks on the Phou Bia areas.

20. *Corroborating Evidence.* Several H'Mong reports provide significant substantiation of the testimony of the Lao pilot. The chief of eight villages, for example, described attacks covering all seven days of the week of 5 June 1976 in the Bouamlong area, Xiangkhoang Province. He described L-19 aircraft firing rockets that produced red and green smoke. Ten villagers were killed by gas and 30 by shrapnel. Most of the H'Mong reports documented by a US foreign service officer in June 1979 and a Department of Defense medical team in October 1979 are consistent with the Lao pilot's testimony. H'Mong observers familiar with military aircraft reported L-19s until late 1978. After that time, reports described jets or "MIGs" and some accurately described Soviet AN-2s.

21. [redacted]

As is discussed in chapter III, the Soviets supervise the chemical warfare activities in Laos; we assume, therefore, that chemical munitions are handled in about the same manner as in the USSR. No protective clothing or special decontamination equipment is required for loading chemical bombs on aircraft and helicopters at chemical munitions test ranges, according to former Soviet chemical warfare personnel.

22. The Lao pilot's description of the rockets used on the L-19 was corroborated by other sources. A H'Mong refugee, a former commmander of a 500-man resistance force, reported that in 1977 he found a rocket canister and a separated warhead that he believed were the kinds used by the Vietnamese and Lao. The canister, he said, had authentic US markings identifying it as a US-manufactured 2.75-inch rocket, as well as three lines of Russian writing (which he could not translate). Another H'Mong resistance force officer, who reportedly had been trained as a liaison officer and ordnance expert before the Communist takeover of Laos, stated that he too believed the rocket canister was of US manufacture and that the Soviet technicians in Laos had modified the upper stage to contain a poisonous (lethal) chemical.

23. The diameter of the warhead was reported to be 12.5 centimeters (5 inches), probably a measurement taken on a modified warhead because the United States does not have a 5-inch warhead for the 2.75-inch "rocket motor." During the Vietnam conflict, about 35 million US-manufactured 2.75-inch rockets were sent to the war zone, and many tens of thousands of these no doubt fell into North Vietnamese hands when South Vietnamese forces collapsed. The usual US fills for these rockets were white phosphorus, high explosives, flechettes, and some CS (riot control agent). The Vietnamese may be using some of these rockets with existing loads, but modified warheads for the 2.75-inch rocket motor could easily be fabricated in Vietnam and filled with a lethal or nonlethal agent in Laos, especially with Soviet assistance. According to US experts, fabrication of a warhead 5 inches in diameter, necked down to fit the 2.75-inch rocket, could be accomplished by trained technicians in a small, well-equipped machine shop and laboratory.

24. *Other Evidence.* [redacted] learned that a special Laotian Air Force unit is responsible for chemical rockets. This unit is commanded by a Soviet-trained Lao and has a Soviet rocket expert attached as an adviser. Modification of captured US-manufactured 2.75-inch rockets to contain lethal CW agents reportedly is done routinely in Laos, with chemical agents supplied by the Soviets under the direction of Soviet and Vietnamese experts. Small, but adequately equipped three- and four-man facilities for this activity reportedly are located in Vientiane, at Phongsavan in Xiangkhoang Province, and in Savannakhet Province.

25. [redacted] information provides a picture of the Laotian chemical warfare organization

and the direct involvement of the Vietnamese and the Soviets in supporting that effort. The Supreme Headquarters Command in Vientiane controls the Regional Military Chemical Sections.

26. In the fall of 1981 the United States discovered trichothecene toxins on a vegetation sample collected from Kampuchea. This led to a reanalysis of samples taken from Laos since 1979. Two samples of a yellow substance collected from different areas showed high levels of trichothecene toxins. New samples were received in late 1981 and are currently being analyzed.

27. The discovery of trichothecene toxin as the mysterious lethal agent that eluded US analysts for many years has somewhat overshadowed a significant body of earlier evidence that several different types of agents—lethal and incapacitating—have been used over the years.

28. There is even some evidence to suggest that in the early years the Laotian and Vietnamese forces were experimenting with different agents and delivery systems in search of an effective way to exterminate the H'Mong or drive them out of Laos.

29. A Pathet Lao soldier is reported to have told H'Mong villagers in early 1978 that an agent sprayed over their villages as a test had not been effective but that he could provide them an antidote if they were affected by the agent. Dispersal of this particular agent was associated with a "black rain." When it was effective, the symptoms were quite different from what has been described after "yellow rain" attacks. Drops on bare skin caused severe necrosis, rotting skin, and high fever that sometimes resulted in death.

30. In a number of the refugee reports, the eyewitness accounts describe the "red gas" as being more lethal than the "yellow cloud." A former Lao Army captain stated that the "red gas" caused the H'Mong to die within 12 hours. An employee of an international organization interviewed victims of a 15 September 1979 attack where nonlethal rounds preceded an attack by five or six "red gas" bombs that covered a 500-meter area. Persons within 30 to 100 meters of the circle died in 10 minutes after severe convulsions. Others had headaches, chest pains, and vomiting but did not die.

31. While it has been difficult to associate specific symptoms with the colors, it is apparent in reviewing reports back to 1976 that several different agents have been used. The different colors cannot be dismissed as only smokes used to mark target areas. In many cases it appears that irritants or incapacitants have been used on H'Mong villages before use of a lethal or heavy-casualty-producing agent like nerve gas or toxin.

32. The method of dispersing agents also varies. Several types of aircraft and helicopters have been used. There have been questions raised about the effectiveness of agent delivery at the high altitudes reported (7,000 to 10,000 feet). Airburst rockets could be fired from high altitudes effectively. Many reports, however, including those from H'Mong soldiers, described attacks made at 1,000 to 3,000 feet. The Lao pilot described firing the chemical rockets from altitudes higher than would be normal for conventional rockets. A number of reports, especially from 1977 and 1978, describe chemical attacks by 105-mm artillery and 122-mm rockets. One report from a H'Mong officer described 122-mm chemical rocket attacks from Louangphrabang Airfield on a village 8 to 9 kilometers away.

33. [redacted] a Lao military report confirmed that poison chemicals had been dispersed by the Lao Government in an effort to kill Lao hill tribesmen. [redacted] confirmed that toxic chemicals had been spread and described small yellow grains. [redacted] a hospital at Paksane requested assistance in treating a large number of villagers suffering from nausea and bloody diarrhea. [redacted] reports revealed that Lao military units were setting up classes in the use of chemical weapons and protection from their use by the "enemy." One report stated that "enemy forces" entered Laos from Thailand with liquid toxic chemicals to poison Lao units' food and water.

34. [redacted] reports suggest the not surprising fact that the chemical warfare program is compartmented within the Lao military, and that field units

are now acquiring knowledge about chemical warfare activities previously restricted to specialized units and individuals. This accords with the secretive nature of the Vietnamese-directed chemical activity reported by the Lao pilot. Lao troops probably started receiving a heavy dose of propaganda about an enemy chemical threat in order to offset spreading knowledge of the government's use of lethal agents.

35. In a 15 December 1981 press conference in Beijing, a former Lao Health Ministry Bureau Director, Khamsengkeo Sengsthith, said that the Vietnamese were using chemical weapons "in the air and on the ground" in Laos, killing "thousands." He said the Vietnamese alone were using chemical weapons, keeping the affairs secret from the Laotians. Furthermore, he stated that 3,000 Soviet advisers are in Laos and they "have taken control" of the Lao Air Force while 40,000 to 50,000 Vietnamese troops have reduced Laos to colony status. We believe that few people in the Laotian military and government are aware of the Vietnamese/Soviet-directed chemical warfare activities.

II. CHEMICAL WARFARE IN KAMPUCHEA

Key Judgment: Vietnamese forces have used lethal trichothecene toxins on Democratic Kampuchean troops and Khmer villages since at least 1978. Again, medical symptoms indicate that irritants, incapacitants, nerve agents, and a highly effective hemorrhagic agent or mixture of agents also have been used.

Nature of the Evidence

36. Since October 1978, radiobroadcasts, press releases, and official protests to the United Nations by the leadership of the Democratic Kampuchea (DK) dissident group have accused the Vietnamese and the Hanoi-backed People's Republic of Kampuchea (PRK) regime of using Soviet-made lethal chemical agents and weapons against DK guerrilla forces and civilians.

In November 1979, however, the guerrilla forces of the Khmer People's National Liberation Front reported that the Vietnamese had attacked them with a tear gas which, from their description, resembled CS. Subsequently, Thai officials, DK informants and refugees, defectors from the People's Army of Vietnam (PAVN), US and Thai medical personnel, officials of the International Committee of the Red Cross (ICRC), and Canadian and West European officials also have implicated the Vietnamese in the offensive use of lethal and incapacitating chemical agents in Kampuchea.

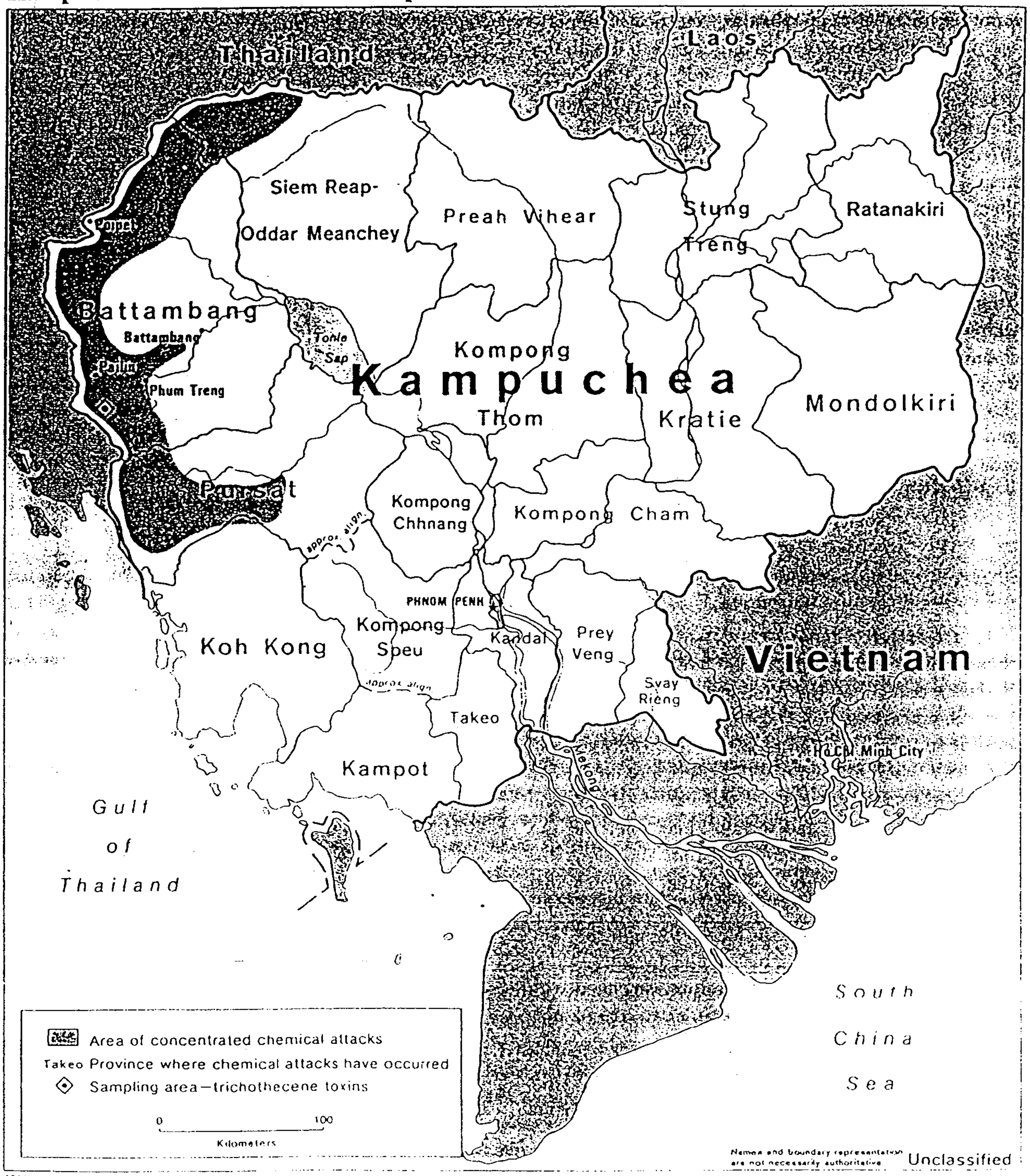
37. The conflict in Kampuchea differs from that in Laos in that the UN-recognized government of Kampuchea, Pol Pot's Democratic Kampuchea group, is operating as an organized guerrilla force. DK reports cannot be taken at face value. Pol Pot's forces are engaged in a propaganda effort against the Vietnamese, and many of their reports must be assumed to be false or grossly exaggerated.

According to DK officials, chemical attacks have occurred in 11 Kampuchean provinces and were concentrated in the provinces of Battambang and Pursat, along the Thai-Kampuchean border. (See figure 6.) The DK also accused the Vietnamese of poisoning food and medicines given to Kampuchean civilians. The Vietnamese have counterclaimed that the DK is poisoning Vietnamese food and water supplies with toxic plant extracts, including strychnine.

38. Official DK radiobroadcasts and press releases have stated that the PAVN-PRK chemical attacks produce symptoms ranging from mild, temporary incapacitation to severe incapacitation and death. Initially, in October 1978, the DK description indicated that a riot control chemical was used. The DK did not publicize symptomatic effects ascribed to lethal agents (as did reports from Laos) until the plight of the H'Mong refugees had been published in the Thai press and other news media.

39. The DK also reported that the Vietnamese were spreading a ground contaminant that produced severe swelling of the feet, tissue destruction, pus formation, and gangrene, with death occurring in one to three days. Because some Pol Pot forces do not wear shoes or sandals, a persistent vesicant or mixture of vesicants similar to the arsine and mustard class of compounds when used in this way could produce these effects.

Figure 6
Kampuchea: Chemical Warfare Operational Areas



40. As early as August 1979, there were reports of the use in Kampuchea of lethal chemicals that caused vomiting, internal hemorrhaging, and death. Reporting by various sources, not directly connected with the DK, claimed that the PAVN and the PRK were attacking DK guerrillas with lethal and incapacitating chemicals delivered by artillery (60-mm and 120-mm), 107-mm rockets, M-79 grenade launchers, aerial sprays, rockets, and bombs. A total of 124 separate chemical attacks in which 981 individuals died have been reported since 1978.[6]

41. Aerial attacks reportedly were made with fixed-wing aircraft and helicopters spraying yellow and white aerosols that were usually lethal. Artillery chemical shells produced white and black smokes that were usually incapacitating. Liquid-type toxic chemicals reportedly were used in boobytraps. Lethal compounds allegedly were introduced into water supplies used by DK forces and refugees and into food and medicine given to Kampuchean civilians. PAVN deserters have reported Soviet involvement in transporting PAVN troops to forward areas and in firing chemical weapons, probably rockets, which exploded and emitted a deadly smoke.

42. [redacted] reports that the Vietnamese have employed toxic chemicals against DK troops and civilians. According to [redacted] reports, lethal and nonlethal chemicals were disseminated as a spray or smoke directly against DK forces and also were used to poison water supplies, food, and terrain along roads such as route 10 from Phum Treng to Pailin and along the Thai-Kampuchean border. Reporting indicates that anyone coming in contact with the apparently persistent chemical used on terrain bleeds through the skin, suffers congestion, vomits blood, and eventually dies from the effects. These symptoms are associated with trichothecene toxins.

43. [redacted]

[6] See annex A

44. [redacted] operations regiments of the 4th Infantry Division would receive protective equipment and training in its use. CW training exercises have been confirmed [redacted]

45. [redacted] a 17-vehicle convoy was transporting lethal and incapacitating chemicals to forward areas in Battambang and Siem Reap Provinces.

46. [redacted]

47. ***Sample Collection and Analysis.*** A program to collect and analyze environmental samples possibly contaminated with CW agents was initiated in late 1979. Samples, reportedly from areas of chemical attack, include clothing reportedly taken from DK victims of a gas attack, an artillery shell casing, food (corn) samples, water samples, leaf samples, and human tissue. Background vegetation and water samples were also collected for baseline data.[7]

48. These samples were analyzed for standard known chemical warfare agents and the results were negative. Special analysis of water and vegetation samples showed the presence of mycotoxins of the trichothecene group.[8]

49. *Medical Examinations.* DK victims of gas attacks have been interviewed by qualified medical personnel, including doctors, registered nurses, and trained medics from the United States, Thailand, and international organizations. Autopsies reportedly were performed on DK soldiers killed in the area attacked with trichothecene toxins.[9]

The Evidence

50. *Indications Before 1980.* There is no doubt that in 1978 and 1979 the Vietnamese and PRK forces made at least limited use of riot-control chemicals and possibly of incapacitating agents against both Communist and non-Communist guerrilla forces in Kampuchea. The chemicals used probably included screening

[7] See annex B.

[8] See annex D.

[9] See annex E.

smokes, riot-control agents such as CS, and an unidentified incapacitating agent that causes vertigo and nausea and ultimately renders victims unconscious.

51. DK officials attempted to provide the ICRC and international newsmen with substantive evidence that joint PAVN-PRK forces were using CW against DK forces. DK troops delivered to the ICRC blood specimens from alleged poison-gas victims. An independent laboratory under the direction of the ICRC reported the results of the analysis of the samples as being either indeterminate or negative. The ICRC also reported receiving a 60-mm shell containing a CW agent, but they have not released any analytical results. According to an ICRC representative in Bangkok, all physical evidence received by the ICRC on the use of CW in Kampuchea was sent to Geneva for analysis by independent laboratories. We have no reports of analysis of samples, other than that of blood specimens.

52. Several canisters have been discovered near the Thai-Kampuchean border which apparently contain nonlethal military chemicals. Smoke billowing from one of the canisters reportedly "numbed" one of the soldiers, who recovered after a brief hospitalization. DK troops found a gas grenade in an area that had been attacked by the PAVN. The reported description of and markings on this grenade fit those of a US CS grenade (ABC M-25A2), a weapon probably among US supplies captured by the Vietnamese. Vietnamese defectors have described chemical attacks using riot-control agents and incapacitants, and in some cases it appears that captured US stocks of CS riot-control agents were used. However, as previously stated, the United States did not have any type of lethal or incapacitating agents in Vietnam.

53. *New Evidence in 1980 and 1981.* In February 1980 the DK accused the Vietnamese of spraying poison gas in northwestern Battambang Province. Reporting indicated that the Vietnamese were using 60-mm mortars, 120-mm shells, 107-mm rockets, and M-79 grenade launchers filled with chemical agents as well as munitions delivered by T-28 aircraft.

54. information in February 1980 on 60-mm shells filled with agents that affected the blood and nerves. In late February the DK planned to exhibit poison victims to the ICRC in Bangkok and provide samples of blood and clothing, which in fact were sent to Geneva for analysis.

55. According to the DK, the chemicals used were green and yellow, and powderlike in appearance. In some instances the gas was described as yellow or white. The symptoms described were tightening of the chest, disorientation, vomiting, bleeding from the nose and gums, discoloration of the body, and "stiffening of the teeth." In July 1980 the DK described artillery attacks that produced a black smoke causing itchy skin, weakness, skin lesions, and in some cases decaying skin and blisters.

56. In mid-July, Vietnamese troops had stated that rocket propulsion systems were inside two large aluminum tanks being taken to the Phnom Var Mountains to be assembled with gas warheads for use on DK forces.

57. In December 1980, reporting revealed that the Vietnamese were once again firing chemical artillery shells, and it was believed that poison chemicals were being brought into the Thai border area. By March 1981 the DK had reported numerous attacks with lethal chemical agents and the poisoning of food and water. The DK reported planes that dropped a white or yellow powder, artillery fire that produced a white or black smoke, and a viscous material with the consistency of toothpaste that was put into cigarette packs left along trails and that emitted a lethal "gas." This "gas" caused instant death, whereas the "gas" from the planes caused a sequence of symptoms, including massive bleeding, rapid deterioration of the internal organs, and seepage of blood from the skin.

58. In March 1981 a team trained to collect samples with special containers went into an area within hours after an attack and collected samples of vegetation and water. The team performed its own analysis on the samples, some of which, however, were turned over to US officials and eventually analyzed by the Army's Chemical Systems Laboratory. Later, one of the samples, a leaf and stem, was found to contain high levels of trichothecene toxins in an analysis performed at the

University of Minnesota.[10] The symptoms described by the DK are consistent with those caused by the toxins found on the leaf sample. Furthermore, a US Government doctor was shown autopsy reports performed by paramedics on victims in the attack area where the vegetation and water samples were collected.

59. The Thai have become increasingly worried about chemical attacks against their own forces and civilian population. In March 1981 at least one Thai died from a toxic agent placed by Vietnamese troops and others became ill after suffering bleeding from the nose and mouth; it is not clear how the Thai came in contact with the poison(s). Thai officials have issued strict orders concerning buying food and drink in Kampuchea and the Thai border area. In May 1981, two Vietnamese were captured in a Thai relocation camp for the Kampucheans as they were attempting to poison the water supply. The poison was analyzed and found to contain lethal quantities of cyanide and an unidentified hydrocarbon.

60. In May 1981 the DK was prepared to send two gas victims to Tokyo to be interviewed. In 1980 the Japanese refused to accept a contaminated sample because of Japanese laws governing the import of such material. We do not know what became of the DK victims.

61. An unexploded "B-40" rocket was obtained by the Thai in June after an attack in which two other rockets released poison gas. In July, analysis revealed the movement of trucks loaded with blue sacks filled with white powder. Sources stated that the chemicals caused blindness, hemorrhaging, and vomiting. The chemicals were being moved into the Pursat, Battambang, and Siem Reap areas.

62. The DK began reporting chemical attacks again throughout the period from September to November 1981. These included reports of deaths from aerial and artillery attacks as well as more reporting on water poisoning. In September and October a US doctor and a nurse, affiliated with an international volunteer organization, treated DK victims of a chemical attack in a DK hospital. Blood samples were rushed to the United States for analysis on two occasions.[11] The nurse related the DK version of the attack, which differs from descriptions of other attacks. While retreating from combat with the Vietnamese, DK soldiers hit tripwires that set off some type of chemical smoke pots, killing some 20 soldiers and making many others ill for more than a month. Another report, on 13 November, described a similar incident early that month when a DK unit, withdrawing from a clash with Vietnamese forces, activated devices "hanging in the trees" which disseminated toxic chemicals.

63. In March 1979, during PAVN operations against Khmer Rouge forces in the Phnom Melai area, a PAVN private observed the following related to chemical warfare activity. At a point in the fighting, all regiment (740th) troops were issued gas masks. However, the 2nd Battalion, a "border defense unit," was not issued masks (reason unknown). This unit was in the Phnom Melai area and was virtually surrounded by Khmer Rouge forces. At a point in the fighting, the regiment's troops were ordered to fix masks. The source allegedly saw two Soviets (Caucasians) fire a "DH-10" (the weapon was so identified by the source's comrades). The source was approximately 50 meters from the firing point. The weapon at impact (which the source apparently was able to observe from his position) gave off clouds of white, gray, and green gas/smoke. His signal unit subsequently passed a message which reported that there were 300 dead, including Khmer Rouge and Vietnamese of the border defense 2nd Battalion. The source claimed to have seen the dead. The corpses had traces of white and green powder on their faces and clothes. The faces were contorted, with eyes wide open. No blood was seen. We note that a H'Mong resistance leader described an incident in 1981 where two Soviet soldiers fired a hand-held weapon that dispersed a lethal agent.

[10] See annexes B and D.

[11] See annexes B and D.

III. THE SOVIET CONNECTION

Key Judgment: The one hypothesis that best fits all the evidence is that the trichothecene toxins were developed in the Soviet Union, provided to the Lao and Vietnamese either directly or through transfer of technical know-how, and weaponized with Soviet assistance in Laos, Vietnam, and Kampuchea. There is no intelligence at hand to support alternative explanations, such as completely independent manufacture and use by the Vietnamese. It is highly probable that the USSR also provided other chemical warfare agents. While the evidence on the Soviet role does not constitute proof in the scientific sense, the Intelligence Community finds the case to be thoroughly convincing.

The Soviet Role in Southeast Asia

64. The Soviets have had advisers and technicians working in Vietnam, Laos, and Kampuchea for many years, but it was not until early 1979 that evidence surfaced on their direct involvement in chemical warfare activities. [ ] ordered the Southern Region command in Pakxe to prepare its chemical storage facilities for inspection by unidentified Soviet military personnel. [ ] the chemicals to be inspected were those that cause "stomach sickness and death."

65. [ ]

66. A separate source stated that the chemical section in Xiangkhoang prepared Soviet-manufactured chemical items for inspection by a Soviet military team on 7 February 1979. A seven-man Soviet team of chemical artillery experts, accompanied by Laotian chemical officers, inspected chemical supplies and artillery rounds at the Xeno storage facility on 1 June 1979. One report stated that the Soviets would be inspecting the same chemical explosives used to suppress the H'Mong resistance in the Phou Bia area. [ ]

[ ]

67. In addition to the intelligence information cited above, which we believe to be reliable, there have been a number of eyewitness accounts of Soviet advisers and technicians participating in the preparation of the chemical weapons for the attacks on the H'Mong villages. Several Laotian defectors have reported seeing Soviet advisers present when aircraft were loaded with chemical-agent rockets. We have not been able to confirm a report that the Soviets have a factory in Vientiane where they mix agents and prepare them for shipment to the regional storage facilities. H'Mong eyewitnesses claim to have seen "Caucasian pilots" in aircraft, and one H'Mong report states that a Soviet aircraft was found in the jungle with a dead Soviet pilot. In November 1981 a H'Mong resistance leader described how Soviet soldiers fighting with the Lao used hand-held weapons that fired chemical munitions a distance of 200 to 300 meters. The lethal chemical dispersed from the munition had a killing radius of 15 meters. This type of report remains suspect, but is not dismissed because of the known Soviet involvement with the Laotian chemical warfare program.

68. In February 1982, information was received that supports the contention that the Soviets supply chemical weapons to the Vietnamese. A Soviet shipment of wooden crates filled with canisters of "deadly toxic chemicals" was unloaded at the Ho Chi Minh City port in July 1981, according to a former official of the Public Security Office of the Vietnamese Ministry of Interior; this office is responsible for special port security. Through personal observation and debriefings of security personnel, he was able to describe the July incident, in which Vietnemese soldiers were caught pilfering the wooden crates containing the chemical canisters. Special security personnel, who were always present when sensitive military shipments from the USSR were offloaded, immediately isolated the area and told soldiers that the round canisters, which were individually sealed in nylon, contained "deadly toxic substances." The wooden crates, each weighing 100 kilograms, were loaded on military trucks and taken to the Long Binh Storage Depot under special guard.

69. The Soviets have most likely been shipping chemical munitions to Vietnam for many years. In 1975 a source who participated in an operation in the Black Sea to salvage the sunken wreckage of a ship that had been carrying supplies to Vietnam described how the divers were affected when they attempted to remove toxic chemicals. A special Soviet salvage unit took over the operation after the divers became ill. The source was told that the substance was a deadly "dust"-like material.

70. Two Vietnamese corporals from the 337th and the 347th PAVN divisions stated in recent debriefings that Soviet-supplied chemical weapons were stored in caves near Lang Son at the time of the February 1979 Chinese incursion into Vietnam. Division units were issued gas masks, but were told that the Soviet-supplied chemical weapons would not be used unless the Chinese initiated chemical warfare. Both sides later charged that the other used chemical weapons, but there is insufficient evidence to substantiate any of the claims.

71. Since the first reports of chemical attacks in Southeast Asia in 1976, we have tended to interpret the Soviet role as strictly advisory. There is considerable evidence now, however, to suggest that the Soviets may be far more involved in the Laotian and Vietnamese chemical warfare program than we assumed in earlier assessments. While more evidence will be needed to make a firm judgment, analysis of the available intelligence leads to the hypothesis that the Soviet military not only aids the effort, but benefits from the use of chemical weapons in Southeast Asia.

Motivation for Using Chemical Weapons

72. The Soviets have made a large investment in ensuring that Vietnam and its puppets succeed in extending their control over Indochina. Much of the Soviets' interest in this region is dictated by their power rivalry with China. Regional Communist forces have been strengthened to contain Chinese influence and deter military incursions. The area of northern Laos where the H'Mong have stubbornly resisted and harassed Vietnamese forces is strategically significant to the Vietnamese because it adjoins a hostile China. In the last few years the Vietnamese have expanded their military construction and strengthened their forces there. For Vietnam, the H'Mong resistance is a major irritant to be removed as quickly and cheaply as possible. To that end, much of the H'Mong population that lived in the Phou Bia mountain region has been driven into Thailand, killed, or resettled. About 50,000 of an original 300,000 (in 1975) remain. The use of chemical agents has played a major role in driving the H'Mong from their mountain strongholds, relieving the PAVN/LPLA ground forces of the need for costly combat in difficult terrain.

73. The Soviets and their allies were no doubt confident that chemical warfare against the H'Mong in remote regions of Laos could be conducted without detection or at least without effective international opposition or condemnation. They have denied such charges as have been made to date, and have made counterclaims that the United States used chemical warfare in Vietnam. In Kampuchea they may also have calculated that, in view of the lack of international support for Pol Pot's regime, chemical weapons could be used on his troops and troops of lesser known resistance forces without any significant international outcry.

74. There remains the question of the choice of chemical agents and particularly of toxins that cause such bizarre and horrifying symptoms. Chemical weapons offer some real advantages over conventional bombing and artillery strikes, napalm, white phosphorus, and infantry operations. Caves and rugged terrain in Laos and thick jungles in Kampuchea have frustrated attempts to locate and destroy the resistance forces. Chemical clouds can penetrate the heavy forests and jungle canopy and seep into the mountain caves. Persistent agents linger in the area and cause casualties days and sometimes weeks after the attack. Unprotected forces and civilians have little defense against lethal agents including toxins, nerve agents, and blister agents.

75. Trichothecene toxins have the added advantage of being an effective terror weapon. Severe bleeding, in addition to blisters and vomiting, instilled fear in the resistance villages. Not only are the villagers and their animals being killed in a gruesome manner, but the vegetation and water also are contaminated. Survivors are loath to return to their inhospitable homes and

instead make the long and dangerous trek to camps in Thailand.

76. There is no clear-cut explanation of why trichothecene toxins have been used in addition to irritants, incapacitants, and other traditional chemical warfare agents. We can only speculate that they are probably cheaper to make and are readily available from Soviet stocks; they are probably safer and more stable to store, transport, and handle in a Southeast Asian environment, and may require less protective equipment when being prepared for munitions. It is clear that they have caused high casualty rates and have been effective as a terror weapon. Moreover, they are difficult to trace as the causative agent after an attack—as demonstrated by the long-delayed US detection. Very few laboratories in the world have the analytical capability to identify precisely the type and amount of trichothecene toxin in a sample of vegetation, soil, or water.

77. Several of the H'Mong reports suggest that Southeast Asia is being used as a laboratory to test chemical weapons. In one case, Vietnamese and Laotian troops entered a village after an attack and took about 20 survivors to a hospital for examination. Victims were treated with different antidotes. The detailed description provided by a H'Mong, who was one of the survivors taken to the hospital, is one of the few cases available on poststrike medical analysis.

78. We suspect that the Soviets, Vietnamese, and Laotians have gained significant information on chemical agent effects on humans, although information on poststrike analysis is very limited. Years of aerial and artillery chemical dispersion has undoubtedly provided the Soviets with valuable testing data. Southeast Asia offered the Soviets an opportunity to test old agents that had been stockpiled for many years as well as more recently developed agents or combinations of agents. A common feature in the descriptions of chemical attacks is the delivery of several types of agents on a single target, sometimes simultaneously, more often sequentially. In some cases, irritants or incapacitants were used first, followed by a second attack with a lethal agent.

Alternative Explanations

79. As a further check on our inference of a crucial Soviet role in the chemical warfare activities in Indochina, we have hypothesized and considered the plausibility of several alternative explanations of the phenomena observed. These hypotheses are described in the following paragraphs. It is our opinion, however, that none of these alternatives fit the data as well as the hypothesis of a direct Soviet connection.

80. *Are the Vietnamese and Laotians using captured US chemical stocks?* The Vietnamese are known to be using captured US aircraft, artillery, munitions, and chemicals such as smoke flares, and the riot-control agent CS. However, the United States did not have lethal agents in Vietnam, and stocks of defoliant were removed long before the Vietnamese Communists took over. The United States had no chemical agents in Vietnam or in the US stockpile that would cause symptoms of the sort associated with "yellow rain" or other lethal chemical attacks observed in Indochina. Agent Orange or any other defoliant would not cause the types of visible physical symptoms and death reported from Laos and Kampuchea.

81. *Are the allegations made by the H'Mong and Democratic Kampuchean forces part of a systematic propaganda or misinformation campaign designed to discredit their enemies?* The evidence, especially after early 1979, is not based solely on refugee reports. However, the H'Mong refugees have been interviewed by doctors, journalists, international refugee groups, congressmen, governors, and officials from several governments. Every qualified observer reported that he believed the H'Mong were describing a tragic event that happened to them, their families, and friends. It is highly unlikely that men, women, and children for over five years have engaged in a sophisticated propaganda campaign that would require considerable medical knowledge of what we now know was toxin poisoning. Furthermore, the H'Mong have not had a well-organized propaganda effort concerning their plight and their story has been championed mainly by interested private citizens and a few governments. Pol Pot, on the other hand, does have a well-established propaganda apparatus that caused analysts to distrust the early reports of chemical weapon use against his Democratic Kampuchean forces. By the summer of 1981, evidence from non-DK sources had fully substantiated the earlier charges.

82. *Have the Vietnamese and Laotians produced their own chemical agents or purchased them from countries other than the USSR?* It cannot be ruled out that the Vietnamese, and perhaps even the Laotians, have produced some chemical warfare agents on their own or purchased chemical weapons or the materials to make agents and delivery systems. Some of the traditional agents like mustard or chlorine could certainly have been prepared in an indigenous chemical laboratory, and the Vietnamese have sufficient capability to manufacture crude delivery systems. Thus far we have positively identified only one class of the agents used—trichothecene toxins—on the basis of analyses of samples from Laos and Kampuchea. These analyses[12] reveal that these particular trichothecenes would not occur naturally in Southeast Asia in the observed combinations and concentrations. It is possible that the Vietnamese could purchase the cultures to make the agent, but that seems most implausible. Rather, it is much more likely that the Soviet Union has produced the toxins for the Vietnamese and supplied the technology to weaponize the toxin. The Soviets have more experience than any other country with these particular trichothecene toxins and have an extensive chemical warfare program in which they could produce and test them. They also have extensive biological facilities in which they could produce the toxin in the large quantities required.

83. *Did the reported deaths occur as a result of the poor physical condition of a population exposed merely to riot control agents?* Several university studies and US Government investigations show that the H'Mong and the Democratic Kampuchean forces are generally in good health and would not have been killed by riot-control agents. Conjectures that many refugees suffered from diseases like tuberculosis and would therefore be vulnerable to nonlethal choking agents are unfounded. It is possible for victims trapped in caves or tunnels to die from a heavy dose of riot-control agent, especially a vomiting agent like adamsite. Few reports, however, describe deaths in caves or tunnels. Most attacks occurred in open air over villages. Credible alternate explanations for the blisters and other symptoms observed on survivors by doctors in Thailand have not been forthcoming. These symptoms are not of the type associated with any known diseases, nor do they resemble those caused by mustard gas.

IV. CHEMICAL WARFARE IN AFGHANISTAN

Key Judgment: Soviet forces in Afghanistan have used lethal and casualty-producing agents on Mujahedin resistance forces and Afghan villages since the December 1979 invasion. There is some evidence that Afghan Government forces may have used chemical weapons provided by the USSR against the Mujahedin even before the invasion. No agents have been identified through sample analysis, but we conclude from analysis of all the evidence that attacks have been conducted with irritants, incapacitants, nerve agents, phosgene oxime, and perhaps trichothecene toxins, mustard, lewisite, and unidentified toxic smokes.

Nature of the Evidence

84. [redacted] Since 1979 a total of 47 separate chemical attacks against Mujahedin guerrillas and villages have been reported by human sources, including Mujahedin resistance fighters, Afghan Army officers, journalists, and medical experts from the United States, Afghanistan, Germany, and France. In the chemical assaults as a whole, a minimum of 3,042 of the Mujahedin reportedly were killed.[13]

85. The reports of chemical warfare attacks indicated that fixed-wing aircraft and helicopters were usually employed to disseminate CW agents by rockets, bombs, and sprays. Chemical-filled landmines were also reportedly used by the Soviets. The chemical clouds were usually gray (or blue-black), yellow, or a combination of the two colors.

86. Medical symptoms reported by victims and witnesses of attacks indicate that nonlethal incapacitating chemicals and lethal chemicals—including nerve agents, phosgene or phosgene oxime, possibly trichothecene or other toxins, and mustard—were used. Several descriptions of the physiological action of

[12] See annexes B and D.

[13] See annex A.

Figure 7
Mujahedin Guerrilla Killed During an Attack on Charbagh Safar Village, Summer 1980

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a chemical agent or of the condition of the corpses of victims were particularly unusual. In one, victims were rapidly rendered unconscious for two to six hours and had no aftereffects. In another, the condition of the bodies included abnormal bloating and blackened skin with a dark reddish tinge, and the flesh appeared decayed. (See figure 7.) In a third incident—which defies explanation—three dead Mujahedin guerrillas were found with hands on rifles and lying in a firing position, indicating that the attacker had used an extremely rapid-acting lethal chemical that is not detectable by normal senses and apparently causes no external physiological responses before death.

87. We have reliable information from several sources that the Soviets had a variety of CW agents available in Afghanistan. Agents included nerve gases, vesicants, and several other casualty-producing agents

88. A former Afghan Army ordnance officer reported that the Soviet army has stockpiled large amounts of artillery shells and handgrenades containing phosgene, diphosgene, sarin, and soman. Stockpiles are in storage sites located in Kabul; in Bala Hissar, at the airport site referred to as Khafaramanag in an underground storage depot; in the Khair Khana district military storage depot near Qandahar City; near Herat; and at the provincial airports of Shindand and Jalalabad.

89. [redacted] indicated the use of chemical warfare agents in Afghanistan as early as 31 May 1979, seven months before the Soviet invasion. It is not known whether Soviet or Afghan pilots conducted the attacks. The chemical munitions were referred to as "microbe bombs" or "chemical bombs" and were to be used to "destroy the Muslims," suggesting a lethal agent.

90. [redacted] the location of chemical bombs, training in CW, and training of Afghan troops in the use of gas masks and the use of lethal chemicals. For instance, on two occasions on 21 August 1980, Soviet aircraft reportedly dropped chemical bombs on a village near Herat, killing 300 insurgents and their sympathizers.

91. [redacted] confirmed the use of chemical munitions by the Soviets against the Mujahedin. These reports neither confirm nor refute the use of lethal chemical agents. One report [redacted] indicated that Afghan and Soviet units used helicopters to disseminate "poisonous gas causing many deaths." Other intelligence shows that:

— Toxic smokes, possibly organic arsenical compounds, were brought into Afghanistan and later withdrawn by the Soviets.

— Chemicals were used to drive insurgents from caves, after which they were attacked conventionally by helicopters.

— Col. Gen. V. K. Pikalov, chief of Soviet chemical troops, and other officials visited a site that had been attacked with a CW agent, designated "IF."[14]

— Soviet units in Mazar-e Sharif had depleted supplies of sodium hydroxide, a potent CW decontamination chemical, and had requested that more be sent immediately.

92. [redacted]

93. [redacted] the presence of Soviet CW reconnaissance and decontamination units at Kabul, Shindand, and Chaghasaray airfields.

94. *Sample Collection and Analysis.* Efforts to collect contaminated environmental samples, Soviet equipment, and materials from Afghan victims of CW were initiated in early 1980. The first sample of rocket tube and warhead fragments was collected in Konarha Province. Since then, 13 additional samples, including Soviet gas masks and clothing from gas victims have been collected for analysis. The last of these, a grain sample, was received in mid-February 1982.

95. Analysis to date has not revealed any standard, known CW agent or trichothecene but analysis is not complete.[15]

96. *Medical Examinations.* Mujahedin refugees, who claimed to have been victims of gas attacks, were examined by medical doctors from the United States, Pakistan, and France. Photographs, descriptions of the symptomatic effects, and descriptions of the corpses of some victims clearly indicate that lethal and casualty-causing agents were used in Afghanistan.[16]

The Evidence

97. The Soviets appear to have used a wide variety of chemical agents in Afghanistan. There are a number of reports that indicate the Afghan military, and possibly the Soviets, used chemical weapons in 1979 before the Soviet invasion. Several Afghan officers have stated that the Soviets supplied both lethal and nonlethal agents to the Afghan forces, in addition to chemical warfare training in the USSR. A substantial body of evidence from all areas of Afghanistan was collected on Soviet chemical attacks throughout 1980. Most of the reports describing large numbers of deaths are from the first three months of 1980 in northeastern Afghanistan. In 1981 more evidence on chemical attacks became available and there are indications that chemical agents will continue to be used. The following paragraphs covering chemical attacks from the summer of 1979 to the fall of 1981 summarize a large body of information. (See figure 10 on page 28.)

98. *Attacks Before the Invasion.* [redacted]

99. A former Afghan Army officer who joined the insurgency claimed that Soviet aircraft dropped canis-

[14] A Soviet designation for several pathogenic Fusarium products or systems is "IIF," which stands for "artificial infection background" (*iskusstevnnyy infektsionny fon*). IIFs involve deliberate contamination of soil in test areas with spores of disease-producing fungi. We do not know if these IIF systems include compounds which are trichothecenes, or even if the IIF and IF designators have a common origin in language. But elsewhere in the Soviet agricultural research program it is known with certainty that there is widespread use of certain trichothecenes involving systems of spray dissemination from light aircrft. A capability exists for multiton production at several Soviet facilities, and such production is known to exist for other spray-delivered microbial products as well.

[15] Descriptions of samples and analytical results are in annex B.

[16] See annex E.

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[redacted]

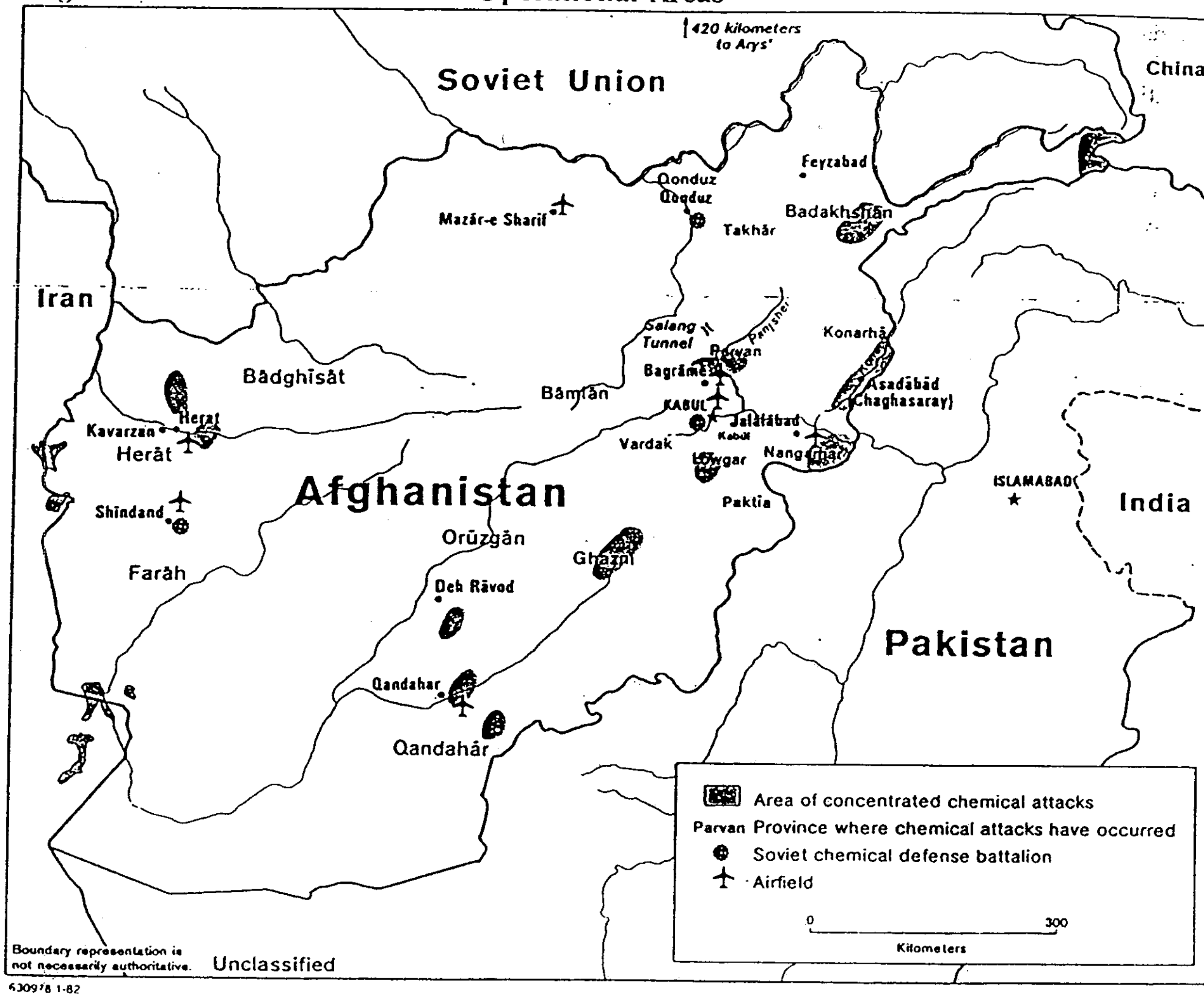
ters containing toxic gas on insurgents in Bamian Province during June and July 1979. He also reported that rumors circulating in the Afghan refugee community claimed that, in August and September 1979, chemical agents were used to dislodge insurgents attempting to interdict a road in the Salang Pass area northeast of Kabul.

100. An Afghan civil engineer described attacks in August 1979 by possibly MIG-19 or SU-17 aircraft followed by reconnaissance by MIG-25s on a position where a large resistance force was being assembled. He heard that about 2,000 died and personally saw a large number of dead bodies with exposed bones and open wounds that appeared to have been caused by acid. Survivors described an acidlike agent. He was told that the aircraft came from Tashkent in the USSR. He had heard similar reports from Jalalabad and Qandahar.

101. [redacted]

102. [redacted] six "chemical bombs" were expended, along with conventional air munitions.

Figure 10
Afghanistan: Chemical Warfare Operational Areas



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in a strike by Afghan IL-28 bombers from Shindand on targets in Farah, Herat, and Badghisat Provinces on 16 November 1979. Afghan IL-28s were based at Shindand [ ]

103. On 27 December 1979, Soviet jet aircraft reportedly had dropped chemical bombs. The location of this particular attack was not given, but the same report mentioned other chemical attacks in Badakhshan Province.

104. *Chemical Attacks Following Invasion.* After the Soviet invasion of Afghanistan on 17 December 1979, reports were received from many types of sources that both Soviet and Afghan forces were using various types of chemical agents.

105. One report speaks of chemical bomb attacks during the week of 13-19 January 1980 against insurgent forces near Feyzabad and Jalalabad, in the Hazarajet area of Bamian Province, and in Takhar Province, all in eastern Afghanistan. The bombs reportedly exploded in midair, dispersing a "vapor" that felt damp on the skin. Inhalation of the vapor is said to have caused difficulty in breathing, nasal excretions, vomiting, blindness, paralysis, and death. These symptoms are associated with nerve agent poisoning.

106. In mid-January there were other reports alleging that Soviet aircraft and helicopters had attacked remote areas in northeastern Afghanistan, particularly

Badakhshan Province, dropping bombs that exploded and dispersed gas that caused blindness, paralysis, and death. We know that the Soviets launched their first offensive operation in northeastern Afghanistan using air and helicopter strikes from a base inside the Soviet Union and that these air attacks occurred during heavy snowfall against insurgent positions high in the mountain area.

107. In February 1980 a respected Australian journalist and a US official spoke with Afghan refugees from different ethnic tribal areas who described chemical agent attacks that allegedly occurred in several Afghan provinces. One tribal group reported that attackers dropped canisters dispersing a gas but that no casualties occurred. A reported chemical agent attack in another area allegedly caused some people to become ill but did not cause any deaths. Reports from some refugees from Badakhshan Province have alleged that an unspecified number of deaths occurred as a result of exposure to chemical agents used in attacks in that area.

108. Another set of reports that recently became available, concerning the period from mid-January to February 1980, described helicopter attacks in northeastern Afghanistan in which a grayish-blue smoke resulted in symptoms similar to those described by the H'Mong refugees from Laos (heavy tearing or watering of eyes; extensive blistering and discoloration of the skin, later resulting in large sheetlike peeling; swelling in the areas affected by the blister; and finally numbness, paralysis, and death).

109. In early March, following the Soviet offensive in Konarha Province on the Pakistani border, Afghan refugees arriving in Pakistan provided new reports of chemical agent attacks. But, unlike earlier reports describing attacks in which deaths allegedly occurred, these reports describe attacks with an incapacitating agent. In addition to these reports, there are several reliable ones which state that the Soviets used incapacitating agents during the Konarha offensive to allow Soviet forces to overrun resistance forces and capture prisoners.

110. Medical examinations in Pakistan of refugees from a large attack in the upper Konar Valley in February 1980 described red skin and blisters containing fluid described as dirty water. Refugees reported that about 2,000 people were affected after contact with a dirty yellow cloud.

111. An Afghan doctor who worked in Qonduz reported the same type of incapacitants and blister agents as those being used in Konarha, Paktia, and Badakhshan Provinces.

112. [redacted]

113. [redacted]

114. [redacted]

115. The Soviet 108th Motorized Rifle Division [redacted] toxic smoke grenades [redacted] Troops were to wear gas masks when using the grenades and wash their eyes if exposed. By August, more than 2,700 toxic smoke grenades were received [redacted] Other divisions also had toxic smoke grenades, which complicated the withdrawal to the USSR.

116. A Japanese academic in March 1980 at a training camp in Peshawar saw an 8-mm film that showed Soviet helicopters dropping several objects, which caused no explosion and produced a bluish-purple smoke mixed with gray and white, probably in an area northwest of Jalalabad. He was told the attacks caused numerous deaths, but the Hezbi-Islami Party, which operates in that area, refused to make the film available to any international organizations. They believed they were fighting a holy war and did not need to prove that international law was being violated.

117. An Afghan officer trained in chemical warfare in the USSR described the use of incapacitants and blister agents in Afghanistan and remembered their characteristics as described in Soviet manuals. He said the incapacitant munition is effective in a 50-meter radius and causes unconsciousness for varying periods.

118. Col. Gen. V. K. Pikalov, chief of the USSR's chemical troops, brought 20 Soviet officials to tour Afghanistan in April 1980. They were specifically interested in investigating the use of toxic agents in the Herat area. "IF" was the only identification of the agent used. [redacted] On 25 March the Afghan Government had publicized the capture of "lethal US grenades" provided to the resistance. In fact, it was a US riot-control grenade readily available commercially for police forces. According to a reliable source, however, the Soviets used lethal agents near Herat in March and placed the blame for the incident on US-provided chemical weapons used by the insurgents.

119. A Dutch journalist published his eyewitness account of two chemical attacks in the Jalalabad area on 15 and 21 June 1980. He filmed the MI-24 helicopter dropping canisters that produced a gray-white cloud. A victim with blackened skin was photographed (figure 7 on page 23) in the village five hours after the attack. The journalist evidently was exposed because he developed blisters on his hands and a swollen and itchy face. He was exposed in the second attack and it took about 10 days for him to recover from skin lesions, nausea, diarrhea, and stomach cramps. This is one of the best firsthand accounts available from Afghanistan. The agent has not been identified, but it could be a mixture containing phosgene oxime or hydrogen sulfide along with other components.

120. A US journalist described seeing a yellow-green gas that appeared to him to be a highly concentrated CS-type gas with a blister agent associated with it. He said the canisters containing the incapacitating gas were "18 inches long and 8 inches in diameter," which corresponds with many other reports from Afghans. We had heard reports about a lethal gas that causes unconsciousness and then death.

121. In August 1980, [redacted] Soviet attack with chemical bombs on the village of Sya Wusan, 30 kilometers southeast of Herat, leaving 300 dead. Afghan military authorities told doctors in Herat they could not treat the victims and doctors' offices were closed. It was in this time frame that the chemical battalion at Shindand set up an operational decontamination station. [redacted]

122. *Chemical Attacks in 1981.* Soviet helicopter units participated in chemical attacks from 20 to 29 April 1981, in areas east and west of Kabul and in the Konar Valley. These attacks were intended to drive personnel from sanctuaries such as caves in order to engage them with conventional fire. [redacted] Similar operations by helicopters occurred north of Qandahar on 24 and 26 April.

123. An Afghan MI-8 helicopter pilot who defected to the Pakistanis said Soviet forces had used chemical weapons in Badakhshan, Qonduz, and Konarha Provinces. Chemicals in canisters that contained toxic gas, tear gas, and antirespiratory gas, which has an incapacitating effect by causing choking and difficulty in breathing, were manually pushed from the cargo compartments of helicopters. He said there was also a specific gas that is absorbed by the body and leaves the skin so soft that one can pierce it with a finger. In one case, there was a wind shift, and Soviet and Afghan forces were seriously affected. Other sources also have described an incident where Soviet and Afghan forces were victims of their own gas attack.

124. A US doctor of Afghan origin examined victims of a July 1981 attack. His report is detailed in the annex on medical evidence.[17]

[17] See annex E.

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125. Before a Soviet sweep operation in the Konar Valley in September 1981, resistance leaders were told by an Afghan officer that the Soviets had four agents available, but would use only the incapacitant which they could defend against with wet rags over the face. During the operation, Soviet helicopters conducted gas attacks in 25 different areas, using cylinders about 1.5 meters long and 60 centimeters in diameter that exploded 4 to 5 meters above the ground, releasing the incapacitating gas. Some victims lost consciousness, were paralyzed, and recovered; others died, and unprotected areas of their skin turned dark green to blue-green.

126. *CW Agents Used.* A recent report from a wounded Mujahedin fighter in a Karachi hospital reinforces our suspicion that previously unidentified toxins or nontraditional CW agents have been used. This man, described as an expert on Soviet ordnance and use of chemical weapons (but not chemical-biological aspects), told US Embassy personnel on 10 February 1982 that the Soviets are using irritants, a hallucinogenic gas, and an apparent nerve gas. The "nerve gas" was described as an off-white powder generally dispersed from helicopters during artillery or aerial bombing attacks. He said the substance is hard to detect. Victims feel faint and dizzy; subsequently they vomit and began to bleed from the eyes, nose, and mouth. Death rates approach 70 percent. Dead bodies are relaxed and the skin peels off when an effort is made to move the bodies. This sequence of symptoms is consistent with trichothecene toxin poisoning, not nerve agents. This source's cogent and detailed description of symptoms of survivors, up to six months after an attack, are similar to numerous reports from Southeast Asia and supports the growing body of as yet unevaluated claims that toxins cause long-term health effects.

127. The Mujahedin regarded gas as simply another weapon in the Soviet arsenal and had to be urged to discuss CW use. This is typical of the Mujahedin attitude toward the US "preoccupation" with chemical warfare and contributes to the intelligence conclusion that Mujahedin reports of chemical attacks, like the H'Mong refugee reports on CW use in Laos, are not part of a fabricated propaganda campaign.

128. To substantiate the descriptions of chemical attacks in Southeast Asia and Afghanistan, details of reported attacks were checked against military operations at the specific time and place. In a high percentage of the cases studied, military operations of the type described by the victims of chemical attacks did take place. For example, an Afghan emigre in Europe recently repeated a description by an Afghan tribal leader of a Soviet chemical attack with helicopters on a 700-man force that had gathered to conduct a surprise attack on Qandahar in October 1981.

129. The most persuasive case studies are those where samples have been collected and analyzed. Thus far that has been possible only for attacks in Southeast Asia; but the Afghan emigre stated that green gas canisters, which emitted a green-yellow smoke upon hitting the ground, were taken to Pakistan by some of the 400 survivors of the October attack. Attempts are being made to acquire the canisters.

130. We have reliable information that the Soviets have stockpiled lethal and casualty-producing agents in Afghanistan and information, also reliable, on where and when some of them have been used. The agents included nerve agents, phosgene, phosgene oxime, sulfur mustard, and lewisite. The agents used, plus the time and location of the attacks, generally correspond to the refugee reports and recorded military operations. Afghan military defectors have also described the agents being used by the Soviets and pinpointed where they are stored.

131. *Soviet Chemical Defense Equipment and Units.* A number of former Afghan officers have described their chemical warfare training in the USSR, and have listed the different types of agents available to the Afghan military and the Soviets in Afghanistan. Their reports, which date back to early 1980, are similar to a recently acquired clandestine report, except that they described the symptoms caused by the chemical agents without naming them. A former ordnance officer described where the agents were

Table 1

Major Soviet Chemical Defense Equipment at Division Level

Equipment	Units and Number			
	Chemical Battalion	Four Chemical Companies	Other Divison Units	Total
BRDM-RKh [a]	9	16	4	29
TMS-65 jet engine	2	0	0	2
ARS-12/14 [b]	20	12	3	35
DDA-53/66 [c]	4	4	6	14

[a] Wheeled reconnaissance vehicle with chemical, biological, and radiological detection equipment.
[b] Truck-mounted device that uses fluid under pressure to decontaminate terrain and equipment.
[c] Truck-mounted steam chambers for decontamination of clothing.

stored in Kabul, Herat, Shindand, Qandahar, and Jalalabad.

132. Chemical defense battalions—standard in all Soviet divisions—are deployed with the three Soviet motorized rifle divisions operating in Afghanistan at Qonduz, Shindand, and Kabul. Also a chemical company is subordinate to each tank and motorized rifle regiment.

133. The chemical defense battalion is normally equipped with the TMS-65 decontamination vehicle (truck mounted, jet engine), the DDA steam generator, and the ARS spray-type decontamination equipment. Such equipment has the primary mission of reducing the effects of chemical, biological, and nuclear contamination. A secondary mission for the TMS-65 is to lay smokescreens, and for the DDA device to generate hot water for showers.

134. The table of organization of these units includes the major equipment items listed in table 1.

135 Soviet divisional chemical defense forces are sufficient to decontaminate division equipment but are capable of only relatively modest-scale terrain-decontamination operations. If the Soviets were planning fairly widespread use of persistent chemical agents and operations in contaminated areas, additional chemical defense units probably would be required. Such nondivisional units—subordinate to either army or military district headquarters—are located in most military districts in the USSR, but none have been seen in Afghanistan.

136. The nondivisional chemical defense unit closest to the Afghan border is the 126th Chemical Defense Battalion located in Bukhara, in the Turkestan Military District, about 300 kilometers from the border. This unit appears to be manned at no more than half strength and probably would need to be augmented by reserve personnel before deploying outside the USSR.

137. Chemical defense equipment, apparently a reserve stockpile, also is stored in Dushanbe and Kurgan-Tyube in the Central Asian Military District at installations formerly occupied by elements of the 201st Motorized Rifle Division. This equipment was not moved out of the two installations, however, when the division moved into Afghanistan.

138.

139.

140.

Decontamination vehicles also have been seen in the Kabul area.

141.

Decontamination and reconnaissance equipment accompanied a 152-mm artillery unit into operations in the Konar Valley, near Chaghasaray.

142. Soviet troops in Kabul have been observed with what appear to be gas masks in canvas carrying

[redacted]

cases; and [redacted] Soviet forces were instructed to don masks when using "toxic/noxious" grenades. Also, on 24 February 1980 many Soviet troops became ill from carbon monoxide poisoning when they were caught by a traffic jam in the Salang tunnel because they did not have special protective canisters required for carbon monoxide.

143. *Soviet Offensive CW Capabilities.* The Soviet Union has stocked a variety of toxic chemical agents and munitions to meet wartime contingencies. Weapon systems capable of delivering chemical munitions available to Soviet forces in Afghanistan include artillery, multiple rocket launchers, and most tactical aircraft. (See table 2.)

144. Field artillery can be used to disseminate CW agents in large concentrations for short ranges. Chemical artillery munitions (as well as aerial bombs) include both fragmentation and nonfragmentation varieties. [redacted] Dissemination efficiencies (the amount of agent deposited after dissemination) as high as 90 percent apparently have been achieved with Soviet base-ejection

Table 2

Soviet CW Agents and Weapons Systems

Agent	Artillery Munitions (size in millimeters) [a]	Free Fall Bombs (weight in kilograms) [a]	Rocket Warheads [a]
Nerve			
Thickened Soman	—	100	FROG
Sarin	122, 152	100, 250	BM-21 BM-24
Vesicant (Blister)			
Mustard	122, 152	—	—
Thickened Mustard	122, 152	—	—
Thickened Lewisite	122, 152	—	—
Mustard/Lewisite Mixture	—	100, 250, 500, 1,000, 1,500	—
Thickened Mustard/Lewisite Mixture	—	250, 1,000	—
Systemic			
Hydrogen Cyanide	—	250, 500	BM-21 BM-24

[a] Entry indicates availability of delivery system for agent specified.

shells,

145. The lethal agents listed in table 2 are known to be in the Soviet inventory. It has been confirmed that a Soviet agent known as VR-55 is the nerve agent soman (GD) thickened with 3- to 5-percent polymethylmethacrylate. Unthickened soman (GD) may be considered by the Soviets as a viable agent fill for munitions, but the thickened version appears to be favored. Tabun, VX, toxins, and phosgene oxime, on the basis of recent information, may have become standard agents.

146. The Soviets have been interested in the US binary weapons program for over a decade and apparently have conducted research and development in such weapons and may have even tested a few rounds. The Soviets issued a patent for a reaction involving an oxime and an alcohol to yield two CW agents: a nerve agent and phosgene oxime (an urticant). There is, however, no evidence that the Soviets have binary weapons in their inventory.

147. About a dozen major installations in the USSR are known to store chemical defense equipment and are suspected of also storing chemical munitions and/or bulk supplies of agents. One of these—the facility near the town of Arys' in the Central Asian Military District—is located about 500 kilometers from the Afghan border. Although chemical shells reportedly were stored near Arys' before World War II, we cannot confirm that toxic munitions are now being stored at this installation. Any munitions stored there today could be moved by rail to Termez—and then overland across the border—or directly into Afghanistan by air.

148.

Analysis of information from several sources convinces us that in Soviet CW exercises the crews loading CW munitions onto aircraft do not wear protective clothes, nor is decontamination equipment present.

149. Because Afghan insurgent forces have little or no protection, there are several situations in which the use of chemical weapons could be an attractive alternative to conventional munitions. In mountainous areas, where rebels are holed up in caves or other inaccessible areas, conventional artillery, high-explosive bombs, and napalm are not particularly effective. [redacted] an unidentified agent has been used on this kind of target.

150. Another possible use for lethal agents would be to deny terrain to rebel forces. Using persistent agents, the Soviets could contaminate large areas for up to three to five days, especially by air-delivered munitions. Contamination of terrain also could be used to force insurgents into areas more accessible to Soviet troops or into conventional fire zones. Under ideal temperature and wind conditions, the persistent nerve agent thickened soman would be the most effective agent. A KhAB-100 bomb filled with a nerve agent such as soman could cover 4,000 square meters with a contamination density of 7.25 grams per cubic meter and would kill all unprotected individuals.

151. *Effects of Weather and Terrain.* The effectiveness of CW agents is heavily influenced by the terrain, wind, and temperatures. Much of Afghanistan is mountainous, and at elevations below 1,200 meters temperatures rise to more than 38 degrees Celsius nearly every day from June to September. There are few trees, and the centuries-long practice of seeking fuel and forage in this already barren land has denuded the hillside of scrub and bushes. The effectiveness of chemical agents would be degraded in such a harsh environment. Strong gusty winds characteristic of barren mountains would decrease the density of the contamination, and more agent would be required to maintain a lethal concentration. Also, the cold temperatures in winter and during fall nights would reduce the vapor hazard to a minimum. As temperatures rose during the day, however, the agent would vaporize and the hazard would increase. The best dissemination periods in Afghanistan probably would be around sunrise during the spring and fall months.

152. An Afghan officer who defected described chemical attacks with lethal agents from 13 to 19 January near Bamian, Feyzabad, Jalalabad, and Takhar. The US Air Force studied the weather over these areas for that period and concluded that conditions were favorable for the aerial delivery of nerve agents on at least two days at each location. The Soviets are actively engaged in testing methods of disseminating agents to allow delivery on target with minimum influence from certain meteorological conditions. They have tested chemical aerial bomb delivery from light bombers and helicopters as well as multiple rocket launchers and artillery at the Shikhany test range.

V. THE CASE FOR CW USE OF TRICHOTHECENES [18]

Sample Analyses for the Trichothecenes

153. Many of the reports of chemical attacks in Southeast Asia were puzzling in that they described the use of a lethal agent (or agents) that produced symptoms not easily correlated with those known to be produced by traditionally recognized chemical warfare agents.[19]

154. The symptoms most frequently described in Laos and Kampuchea correspond most closely with those produced by a group of mycotoxins, the trichothecenes. Particularly unusual was the repeated description by medically unsophisticated victims of symptoms indicating hemorrhage and degeneration of the mucosal lining of the gastrointestinal tract, symptoms characteristic of trichothecene poisoning.[20] A review of the scientific literature [21] revealed that the trichothecenes had physical and chemical properties ideal for chemical agents; that they could easily be mass-produced; and, also, that they had been the subjects of intense Soviet scientific investigation since the 1930s.

155. For these and other reasons, the decision was made to test for the trichothecenes using the most sensitive and specific methods of analysis available.

[18] This chapter summarizes annex D, which is a detailed presentation of the investigation undertaken to substantiate the case for use of trichothecene toxins in Southeast Asia.

[19] A compilation of the signs and symptoms reported in each country is found in table D-1, annex D.

[20] See annex E.

[21] See annex D, sections IV and V.

Samples were submitted on a blind basis to Dr. Chester Mirocha, the leading US expert on detection of trichothecenes.

156. *Results.* Analyses of four alleged chemical warfare samples (two from Laos and two from Kampuchea) were completed in September 1981. All four showed the presence of extremely high levels of trichothecenes.[22] The samples were collected from the sites of three separate chemical attacks in which victims reported symptoms consistent with trichothecene poisoning. The extremely high levels of toxins found in these samples (150 parts per million of T-2 toxin, 109 ppm of nivalenol, more than 100 ppm of diacetoxyscirpenol, and 66 ppm of deoxynivalenol) have not been reported to occur in a natural environment even under climatic and substrate conditions favorable for their production. Three of the analyzed samples were taken from environments—the surface of rocks or water—that would be extremely unlikely to support natural growth and toxin production.[23]

157. *Conclusions.* When all the factors are considered it is clear that the appearance of these particular toxins in these extremely high levels in environments so hostile to their formation cannot reasonably and scientifically be attributed to a natural contamination. This conclusion is supported by the results of the analyses of controls consisting of vegetation, soil, and water samples from an area adjacent to the Kampuchean attack site. Nivalenol, deoxynivalenol, T-2, and diacetoxyscirpenol were not present—indicating that these toxins do not occur naturally in that geographical area. Even samples of corn and rice from the area—which would provide an ideal substrate for the toxin-producing species—were found to be negative for the trichothecenes.

158. Additional alleged chemical warfare samples, including blood samples from victims of "yellow rain" attacks in Kampuchea were analyzed.[24] Preliminary results on these blood samples are consistent with toxin exposure, but are statistically inconclusive because of the problems encountered in obtaining fresh samples and because of the lack of sufficient controls. HT-2, a metabolite of T-2 toxin, was detected in blood specimens from two victims of a "yellow rain" attack.[25]

159. *Further Efforts.* Collection efforts continue and additional samples continue to arrive. These will be tested for the trichothecenes as well as for other more familiar chemical warfare agents. In addition, many of the samples previously collected and tested for the traditional chemical warfare agents will be reexamined for the presence of trichothecenes.

Natural Occurrence and Significant Properties

160. The trichothecenes are mycotoxins; that is, they are toxins produced by fungi. There are more than 40 structural derivatives known to occur naturally.[26] Trichothecene toxins, more than any other group of mycotoxins, have been associated with acute disease outbreaks in humans; and most of these outbreaks have occurred in the Soviet Union.[27] The Soviets have traditionally had a strong scientific interest in these toxins, and research projects concerning them have been identified with Soviet institutes believed to be involved in classified research related to chemical and bacteriological warfare.

161. Literature concerned with the natural occurrence of these toxins has been relatively scarce because of the lack of convenient detection methods and the complexity of the trichothecene family of compounds. Methods capable of distinguishing between close structural derivatives and of accurately quantifying the levels of toxin present have only recently become available. We do have reports of natural occurrences of T-2 toxin, diacetoxyscirpenol, deoxynivalenol, and nivalenol—reports that were obtained from a literature search of over 3,000 citations concerned with trichothecene toxins.[28]

162. The extremely high levels of toxins found in the CW samples from Laos and Kampuchea, as noted

[22] See annex D, table D-2.

[23] A detailed analysis of the possibility that the levels of toxins found in the Laotian and Kampuchean samples could have been the result of a natural contamination is presented in annex D, section III.

[24] See annex D, table D-3.

[25] These results are detailed in table D-2, annex D.

[26] Some of the most important of these and the fungi that produce them are listed in table D-4, annex D.

[27] See annex D, table D-5.

[28] These reports are listed in annex D, section IV

in paragraph 156, have not been reported to occur in nature. Higher levels of toxin production can, of course, be induced when the mold species is grown in pure culture under ideal temperature and substrate conditions in the laboratory. The Soviets, for instance, have succeeded in producing 4 grams of T-2 per kilogram of substrate under controlled conditions. In a natural environment, however, the *Fusarium* species cannot compete well with other mold species such as *Aspergillus* and *Penicillium*, and levels of toxin produced are lower (in most cases, by several orders of magnitude) than those found in the samples.[29] Several other lines of evidence—including climatic requirements for toxin production, results of surveys of toxigenic fungi in Southeast Asia, and results of controlled studies—support the conclusion that it is impossible to provide a scientifically sound explanation for the natural appearance of these particular toxins at these levels and combinations in an environment so hostile to their production.

163. When one considers the suitability of trichothecenes as chemical agents, factors such as stability, solubility, and ease of production become extremely important. The trichothecenes are very stable and can be stored for years at room temperature with no loss of activity. They are also heat stable, showing no loss of activity after heating at 100 degrees Celsius for an hour. The structure of the compounds allows solubilization of them in a wide range of solvents without affecting the basic toxicity.[30] Although some of the trichothecenes have been synthesized chemically, biosynthesis employing *Fusaria* species is the most effective way to produce large quantities. Almost half of the Soviet open literature concerning these toxins deals with defining optimum conditions for biosynthesis of the compounds.[31]

164. Mycotoxins can be produced in excellent yields employing the same techniques that are used to produce some antibiotics. Both are products of mold metabolism, and an antibiotics installation could provide an excellent cover for agent production facilities. Heavily guarded industrial microbiology plants under military control have been identified in the Soviet Union.

[29] See annex D, table D-7.

[30] See annex D.

[31] See annex D for a representative bibliography.

165. On the basis of their stability, solubility, and production characteristics, the trichothecenes would fit the general requirements for chemical agents. Of course, the most important properties of chemical agents are their toxicological effects.[32] Striking among those for trichothecene toxins are the rapid onset of vomiting and severe itching and tingling of the skin. Hemorrhage of the mucous membranes and bloody diarrhea follow. The correlation between the symptoms reported to have been caused by the trichothecenes and those reported by gas victims in Laos, Kampuchea, and Afghanistan is immediately apparent.

166. Most of the available data concerning the effects of the trichothecenes are the result of animal studies in which pure compounds were administered by oral, subcutaneous, intraperitoneal, or intravenous routes. There are no reports concerning inhalation of mixtures of these compounds. It is difficult, therefore, to speculate concerning the time course and severity of the effects that would be expected in humans exposed to aerosolized mixtures of these potent toxins.[33]

167. The most useful data concerning exposure in humans were obtained in a Phase I clinical evaluation of anguidine (diacetoxyscirpenol) as an experimental anticancer drug. The trichothecene was administered by intravenous infusion, and immediately caused nausea, vomiting, diarrhea, somnolence (and/or mental confusion), fever, chills, a generalized erythema with a burning sensation, hypotension, dyspnea, stomatitis, hives, and ataxia. Another useful body of clinical data concerning the effects of trichothecenes in humans is drawn from descriptions of the course of the disease in the natural outbreaks that occurred in the Soviet Union.[34]

VI. ORIGINS AND EVOLUTION OF THE SOVIET CHEMICAL WARFARE PROGRAM

168. Indications of current chemical weapons used by the Soviets or their allies are more credible when viewed in the context of developments in chemical

[32] The most prominent symptoms associated with trichothecene poisoning are listed in annex D, table D-1.

[33] See annex D, table D-1.

[34] These symptoms are described in detail in annex D, section III.

weaponry generally and of Soviet association with a given development in particular. The modern history of toxic chemical agents dates from World War I. Both the French and the Germans first used lacrimators on a limited scale in 1914. In an attempt to overcome a stalemate, the Germans on 22 April 1915 launched a large-scale chemical warfare attack: chlorine gas was released from commercial cylinders along the front, with the wind blowing in the direction of the unprepared enemy. This attack was highly effective, and the tactic was subsequently repeated.

169. The first chemical shell, developed by the French and used in early 1916 against the Germans, was filled with phosgene (CG). It was succeeded a short time later by shells filled with hydrogen cyanide (AC). In July 1917 the Germans began using shells filled with mustard gas (HD). About the same time the Germans also introduced diphenylchloroarsine (DA), a particulate irritant that could penetrate the protective masks then in use by the Allied troops.

170. Throughout this war both the Allies and the Germans explored the military effectiveness of chemical munitions of varying sorts. The Russians apparently suffered particularly heavy casualties. By 1917 they had produced the Shlem respirator, an effective protective mask. Even so, Russian soldiers continued to suffer heavy casualties, in part because of lack of training. In one particular attack, for example, the Russian soldiers apparently donned their masks but had not been told to remove the plug from the filter canister. The result was that they were either asphyxiated or died from exposure to the gas when they removed the mask.

171. At the close of the war, the Soviet military establishment examined its experience with chemical weapons and reached the following conclusions: (1) It is necessary to be able to retaliate in kind. During the war the Russian forces failed in this totally; only a small portion of total CW agent use was Russian. (2) It is necessary to understand how to use chemical weapons effectively. (3) It is necessary to have protective equipment available to the troops, and they must know how to use it correctly.

172. To rectify these deficiencies the Soviets became involved in all aspects of chemical warfare. The first Soviet military chemical academies were founded, and the Soviets in 1924 negotiated a CW cooperation pact with the Germans. This pact resulted in establishment of the CW proving grounds at Shikhany. The Germans continued their assistance into 1929, when they departed at Soviet request, abandoning all equipment. In that year the Soviets were field-testing mustard thickened with various additives for use in aerial spray tanks.

173. In 1925 the Geneva Protocol was signed by the United Kingdom, France, Germany, and the USSR. In short, this pact prohibited the first use in war of asphyxiating or deleterious gases; the rights to retaliate and to use such gases against nonsignatories were reserved.

174. During the 1930s the Soviets established a large number of CW production plants and began stockpiling agents. They carried out many field test programs, often involving large numbers of animals. They conducted research into new agents, including experiments with phosgene oxime and with mixtures of agents. They built special railcars to transport bulk agents to sites for filling munition systems. They developed the first ARS decontamination vehicles, which could also be used for carrying bulk agents. All Soviet troops were issued Shlem respirators and protective capes and buskins. By the start of World War II the USSR chemical agent stockpile exceeded 140,000 tons: CW agents were the only war supplies the Soviets did not need from the West.

175. Also during this decade the Germans developed nerve agents, and in 1939 began production of the nerve agent tabun (GA). In 1935 and 1936, Italy successfully employed mustard gas in Ethiopia, claiming that the Geneva Protocol did not prohibit use of CW in reprisal against other illegal acts of war.

176. At the outbreak of World War II the United States, like the Soviet Union, had large stockpiles of mustard and phosgene; and the Germans had stockpiled sulfur mustard, nitrogen mustard, and tabun. Toxic chemicals were not used in that war, however, possibly because of the inhibiting effect of probable retaliation in kind.

177. In 1945 the Soviets captured the German nerve agent plant at Dyhernfurth, together with many

of its scientists and technicians. The entire plant was transferred to Volgograd. The Soviets first produced tabun and then switched to production of the nerve agents sarin and soman as the agents of choice. A new agent, VR-55, noted by the early 1950s, was subsequently identified as thickened soman, a modification developed by the British and shared with the Soviets during World War II. It has been suggested that chemical warfare was then viewed by the Soviets as a cheap answer to American possession of nuclear weapons. By the late 1950s good intelligence was available on the existence of Soviet weapon systems for CW agents and of plans for their use, as well as details establishing a commitment to training troops in use of and protection from chemical weapons. Production plants were constructed at Shikhany and Dzerzhinsk during the 1960s.

191. In recent years HUMINT reporting has reflected a continuing Soviet commitment to chemical

defense training, and intelligence from all sources shows protective and decontamination equipment in large amounts and variety. Activity at Soviet CW-related sites has not been affected by US termination of CW agent production. The Soviets have condemned US interest in binary chemical munitions while pursuing similar research. There continues to be evidence that they are working to produce penetrating agents that will defeat Western protection systems.

192. The Soviet Union ratified the 1972 convention banning the production and stockpiling of bacteriological and biological agents and toxins and their means of delivery. They also entered into negotiations with the United States to draft a similar treaty to ban chemical weapons. However, Soviet interest in chemical and biological warfare in all its facets continues unabated, a conclusion quite consistent with the allegations arising from Southeast Asia and Afghanistan.

ANNEX A [1]

TABULATIONS OF REPORTED CHEMICAL WARFARE ATTACKS IN LAOS, KAMPUCHEA, AND AFGHANISTAN

This annex comprises three tables summarizing chronologically, by location, number, and associated deaths, the chemical attacks reported to have occurred in Laos, Kampuchea, and Afghanistan between 1975 and 1981. The tables were compiled from a large volume of intelligence reports on such attacks. Every effort was made to correlate individual allegations with collateral information and to eliminate double counting. The numbers of fatalities shown almost certainly fall short of actual totals because our coverage is inevitably incomplete and many reports failed to provide casualty numbers.

[1] This annex is unclassified.

Table A-1

Laos: Summary of Reported Chemical Attacks and Associated Deaths, 1975-81

Time Period	Area	Attacks [a]	Deaths [b]
Summer 1975	Vientiane	2	25+
Fall 1976	Phou Bia	8	10
	Savannakhet	1	10
Winter 1976-77	Phou Bia	2	16
Spring 1977	Phou Bia	6	66+
	Khammouan	2	1
Summer 1977	Phou Bia	6	95
Fall 1977	Phou Bia	1	25
Winter 1977-78	Phou Bia	10	1,328+
	Savannakhet	6	224
Spring 1978	Phou Bia	34	969+
Summer 1978	Phou Bia	22	664+
Fall 1978	Phou Bia	19	572
Winter 1978-79	Phou Bia	5	15+
Spring 1979	Phou Bia	36	257+
Summer 1979	Phou Bia	5	239+
Fall 1979	Phou Bia	10	56
	Xaignabouri	2	24+
Winter 1979-80	Phou Bia	4	10+
Spring 1980	Phou Bia	3	24
Summer 1980	Phou Bia	6	187+
Fall 1980	Xaignabouri	1	12
	Phou Bia	7	88+
	Savannakhet	3	1+
Winter 1980-81	Xaignabouri	2	57
	Phou Bia	4	82
	Vientiane	1	1+
Spring 1981	Houaphan	2	?
	Phou Bia	7	218
	Vientiane	1	—
Summer 1981	Phou Bia	1	?
Fall 1981	Phou Bia	4	500+
	Khammouan	3	534+
		226	6,310+

[a] This tabulation omits 35 attacks, accounting for 194 deaths, that were not located in the reports. The totals overall were 261 attacks and more than 6,504 deaths.

[b] A plus sign indicates that the report(s) of deaths gave a minimum figure. In some cases (shown with a question mark) deaths were reported but no number was given. Other reports (signified with a dash) gave no information on fatalities.

Table A-2

Kampuchea: Summary of Reported Chemical Attacks and Associated Deaths, 1978-81

Time Period	Area	Attacks	Deaths [a]
1978	Ratanakiri	5	?
Summer 1979	Kampong Speu	4	37
Fall 1979	Siem Reap	1	—
	Battambang	4	22+
	Pursat	2	1+
	Koh Kong	2	[illegible]
	Kampot	1	3
	Kampong Chhnang	2	118
Winter 1979-80	Battambang	12	64+
	Pursat	5	21+
	Koh Kong	2	4
Spring 1980	Battambang	3	20+
	Pursat	8	24+
	Koh Kong	5	13
Summer 1980	Siem Reap	1	82+
	Battambang	3	23+
	Pursat	2	7
	Koh Kong	3	—
Winter 1980-81	Battambang	8	—
	Pursat	2	3
Spring 1981	Preah Vihear	1	—
	Battambang	12	163+
	Pursat	3	42+
	Koh Kong	1	—
	Kampot	1	—
Summer 1981	Battambang	3	7+
	Kampong Thom/Cham	1	—
Fall 1981	Siem Reap	16	305
	Battambang	6	16
	Pursat	3	—
	Koh Kong	1	—
	Kampot	1	—
		124	981

[a] A plus sign indicates that the report(s) of deaths gave a minimum figure. In some cases (shown with a question mark) deaths were reported but no number was given. Other reports (signified with a dash) gave no information on fatalities.

Table A-3

Afghanistan: Summary of Reported Chemical Attacks and Associated Deaths, 1979-81

Time Period	Province	Attacks [a]	Deaths [b]
Summer 1979	Badakhshan	1	2,000 [c]
	Parvan	1	8
	Bamian	1	—
Fall 1979	Konarha	1	350
	Farah	1	?
	Herat	1	?
	Badghisat	1	?
Winter 1979-80	Badakhshan	5	130+
	Takhar	1	—
	Konarha	2	10+
	Nangarhar	1	?
	Bamian	1	?
Spring 1980	Badakshan	1	1+
	Konarha	2	?
	Oruzgan	1	—
	Qandahar	1	—
Summer 1980	Nangarhar	2	1
	Vardak	1	3
	Herat	2	300+
	Kabul	2	—
Fall 1980	Konarha	1	?
	Lowgar	1	4
	Ghazni	1	100
Winter 1980-81	Lowgar	2	?
Spring 1981	Parvan	2	—
	Lowgar	3	—
	Ghazni	2	?
	Qandahar	1	—
Summer 1981	Nangarhar	2	?
	Qandahar	2	16
	Herat	1	119
		47	3,042

[a] This tabulation omits some attacks described in the text because they could not be dated or located with high confidence.

[b] A plus sign indicates that the report(s) of deaths gave a minimum figure. In some cases (shown with a question mark) deaths were reported but no number was given. Other reports (signified with a dash) gave no information on fatalities.

[c] The reported figure of 2,000 deaths in Badakhshan after a single attack in the summer of 1979 is unusually high. We are concerned that the figure may reflect an unverifiable reporting error. In all other respects, however, the report met the criteria established for inclusion in this table.

ANNEX B [1]

COLLECTION AND ANALYSIS OF SAMPLES OF CHEMICAL WARFARE AGENTS AND TOXINS

The specific chemical agents being used in Laos, Kampuchea, and Afghanistan cannot be determined without collection and analysis of at least one of the following: environmental samples contaminated with agent, the munitions used to deliver agents, or biological specimens from attack victims.

Obtaining contaminated samples that will yield positive traces of specific chemical agents is dependent on a number of factors. These include the persistency of the chemical, the ambient temperature, rainfall, wind conditions, the media on which the chemical was deposited, and the time, care, and packaging of the sample from collection to analysis in a laboratory. Many standard chemical warfare agents are nonpersistent and disappear from the environment within a few minutes to several hours after being dispersed. These include, for example, the nerve agents sarin and tabun, the blood agents hydrogen cyanide and cyanogen chloride, the choking agents phosgene and diphosgene, and the urticant phosgene oxime. Other standard CW agents—such as the nerve agents VX and thickened soman and the blistering agents sulfur mustard, nitrogen mustard, and lewisite—may persist for several days to weeks depending on weather conditions. The trichothecene toxins have good persistency but may be diluted to below detectable concentrations by adverse weather conditions. To maximize the chances of detection, sample collections should be made as rapidly after a chemical assault as possible, and with many agents this means minutes to hours. Under the circumstances of Southeast Asia and Afghanistan this has simply not been possible. While numerous samples were collected, few of them held any realistic prospect for yielding positive results. It is fortunate that trichothecenes are sufficiently persistent to allow detection several months after the attack.

Samples have been collected from Southeast Asia since mid-1979 and from Afghanistan since May 1980. To date about 50 individual samples—of greatly varying types and usefulness for analytical purposes—have been collected and analyzed for the presence of traditional CW agents, none of which have been detected. On the basis of recommendations by medical and toxicological experts and of findings by the US Army Chemical Systems Laboratory (USACSL), many of the samples have been analyzed for the trichothecene group of mycotoxins. Four samples, two from Kampuchea and two from Laos, were found to contain high levels of trichothecene toxins. Preliminary results of several additional samples indicate the presence of a trichothecene metabolite in blood samples drawn from Democratic Kampuchea (DK) troops. Quantification of their levels is pending. Details concerning the samples, including the circumstances of their collection, analysis, and the results, are provided in this annex.[2]

All samples were sent to USACSL for analysis, unless otherwise stated. USACSL analyzed all samples for the presence of traditionally recognized chemical warfare agents. Analyses for tricothecenes were conducted by Dr. Chester Mirocha, University of Minnesota, under the sponsorship of the US Army Medical Information and Intelligence Agency (USAMIIA). An independent laboratory in the United States analyzed a few samples for presence of chemical warfare agents.

[2] See the tables on the ensuing pages.

Table B-1

Laos: Sample Collection and Analysis for Presence of Chemical Warfare Agents

Sample No.	Sample Description	History of Sample	Analytical Results
1	Polyethylene plastic sheet, 4 square inches	Collected in early 1979 after a chemical attack on H'Mong village. H'Mong refugee gave to Thai personnel, who in turn passed a small piece to US officials for analysis.	Thai preliminary analysis indicated the presence of a vesicant (blistering agent). Analysis by an independent US laboratory found no evidence of vesicant or any other CW agent.
2	Yellow powder residue on bamboo thatching from roof of hut.	Chemical was sprayed from L-19 aircraft in Pha Mai village in March 1979. All animals in village died. At least 28 people died after vomiting blood, coughing up blood, and suffering massive nosebleed, blurred vision, and difficult breathing. Dried yellow spots on bamboo thatching were about 2.0 millimeters in diameter. Sample given to US Army medical team in October 1979. Analyzed by US Army Chemical Systems Laboratory (USACSL).	Total sample of yellow material on bark was 2 milligrams. No evidence of known chemical warfare agents was present. Lauryl alcohol derivatives, primarily sulfate, indicating a possible surfactant or wetting agent for spreading other chemicals was detected.
3	Human tissue samples from 20 H'Mong reportedly exposed to a CW attack and hospitalized in Bangkok. Twenty urine, 19 blood, and 20 sputum samples and 16 chest X-rays were received. Samples from H'Mong refugees not attacked with chemical agents were used as controls.	Samples were taken in July 1980 from H'Mong who had been exposed to a CW attack. Analyzed for cholinesterase. Control samples from H'Mong refugees not exposed to a CW agent were also analyzed. Samples being retained at USACSL for possible additional analysis.	Cholinesterase activity determinations in the blood of exposed individuals were not significantly different from normal/unexposed persons. Cholinesterase activity was very low in both test and control subjects. No evidence of known CW agents in any of the samples.
4	Yellow/orange powder from chemical attack in vicinity of Phou Bia.	Collected by H'Mong resistance fighter, on day of attack, 25 October 1980. Thirty of 100 people became ill; none died. Given on 21 April 1981 to medical officer of an international organization, who transferred it to US custody. Sample sent to United States 30 April 1981. Container was not opened until received at USACSL.	No evidence of any known CW agent. (Sample contained only 1 to 2 milligrams of powder.) Not analyzed for trichothecene toxins. Tentatively identified a sesquiterpene, which may be indicative of trichothecenes. Also found were a quinone and aromatic hydrocarbons and carbonyls.
5	Yellow powder residue scraped from a banana leaf in vicinity of Ban Don.	Collected by H'Mong refugee after a 1 April 1981 attack on north side of mountain near Ban Don. Sample received by medical doctor from international organization on 21 April 1981 and by US personnel on 30 April 1981. Container was not opened until received at USACSL.	No evidence of any known CW agent. Sample contained only 1 to 2 milligrams of powder. Not analyzed for trichothecene toxins. Analysis did detect sesquiterpene and carbonyl groups which could be indicative of a trichothecene.

Table B-I (Continued)

Laos: Sample Collection and Analysis for Presence of Chemical Warfare Agents

6	Yellow powder (about 350 milligrams) from village of Muong Cha in the Phou Bia region.	H'Mong refugee collected sample by scraping from rocks and leaves after a 13 March 1981 attack in the village of Muong Cha. Refugee arrived in Thailand on 28 April 1981 and gave sample to Thai police authorities, who turned it over to US Embassy officer. Sample forwarded to US on 21 May 1981. Analyzed for known CW agents at USACSL, then transferred to independent laboratory for trichothecene analysis.	No evidence of known CW agent. Aromatic hydrocarbons and carbonyls were present, indicating possible trichothecene. Portion of sample analyzed for mycotoxins of the trichothecene group. T-2 toxin and diacetoxyscirpenol (DAS) were found at levels of 150 and 25 parts per million, respectively. Nivalenol and deoxynivalenol were not detected. Second analysis of sample showed a T-2 toxin level of 143 ppm and DAS at 27 ppm. No nivalenol or deoxynivalenol was detected.
7	Very small amount, less than milligram of solid in 5 milliliters of solution.	First sample taken by a H'Mong from site of a CW attack that occurred on 2 April 1981 at Ban Thong Hak. Twenty-four victims died. Sample was given to a journalist who transferred it to a Congressman. It was given subsequently to USACSL on 11 June 1981. Sample transferred to USAMIIA for analysis for trichothecene toxins. Second sample from same channel received on 30 June 1981.	Sample 1: No evidence of any traditional CW agents. Solvent was methanol. No T-2, nivalenol, or deoxynivalenol was present. Ten nanograms of diacetoxyscirpenol (DAS), a toxic trichothecene, were present in the sample. The small sample size precluded adequate analysis for other trichothecene toxins, and it cannot be determined if they were present or not. Sample 2: Indications of a steroid which could be indicative of a trichothecene. No evidence of known CW agents.
8	Five blood samples	Samples were clotted. Sent to USAMIIA on 17 November 1981. No analysis for trichothecene toxins planned. Symptoms described by victims indicate that the chemical agent was CS or other riot control material.	No exploitation at this time
9	Two samples: — Natural vegetation, stem and leaves. — Plastic bottle containing five samples, three of leaves and two of powder.	Sample of residue collected after a 6 December 1981 CW attack at Muong Phon, 20 kilometers west of Phou Bia. Victims suffered from bloody vomiting and diarrhea. Many deaths. H'Mong carried the sample out of Laos 8 December 1981 [redacted] received it 9 December 1981 and provided sample to Embassy. Received by USACSL on 5 January 1982. One-fourth of sample given to UK for analysis. One-fourth sample to USAMIIA for trichothecene analysis.	Sample 1: No evidence of known CW agents. Analysis incomplete Sample 2: No evidence of known CW agents. Identified 2 methylfuran, cyclo-octatetraene which could be indicative of a trichothecene. Analysis incomplete.
10	Residue	Sample collected by a H'Mong resistance leader immediately after a 12 December 1981 CW attack. Villagers suffered bloody diarrhea, some deaths. Sample given to Embassy official on 8 January 1982 and transferred to UK officials on that date. Sent to London on 19 January for analysis.	

Table B-2

Kampuchea: Sample Collection and Analysis for Presence of Chemical Warfare Agents

Sample No.	Sample Description	History of Sample	Analytical Results
1	Clothing (two pair of trousers, two shirts) from dead Democratic Kampuchea (DK) soldier	On 27 February 1980 a US Embassy officer obtained clothing sealed in heavy plastic bags from Thai official. Clothing reportedly taken from DK soldiers killed in chemical attack in the Pailin area. Clothing sample was obtained two weeks before being given to US officer. Analysis done by an independent laboratory.	No evidence of standard CW agents was detected. Not analyzed for mycotoxins. Cytotoxicity tests were negative.
2	Water sample (25 milliliters)	Sample taken in mid-January 1980 from a stream in the Thaphaya area of the Thai-Kampuchean border by Royal Thai Army (RTA) troops. It was passed to station officer by Thai who claimed that RTA troops and villagers became ill with swelling limbs and a red rash. Analyzed by independent laboratory.	No evidence of standard CW agents was detected. Not analyzed for mycotoxins. Cytotoxicity tests were negative.
3	Red corn (500 grams). Corn contained cob particles, broken kernels, and insects.	Sample obtained from Kampuchean refugee who entered Thailand in early 1980. The corn was provided by the Vietnamese and reportedly originated in Russia. Eating it caused people to vomit and cough up blood. Analyzed by independent US laboratory.	No evidence of known CW agents. Was not toxic to cell tissue culture. No toxic effect noted in rat receiving portion of sample orally. Not analyzed for trichothecene toxins.
4	Empty artillery shell	Sample collected by DK refugee in early 1980. Received 5 May 1980. Sent to independent laboratory for analysis.	No evidence of presence of CW agents or their degradation products. Major constituent was TNT.
5	Shirt taken from DK victim of CW attack.	Attack occurred on 29 February 1980 about 15 to 20 kilometers southeast of Nong Pru. Victim reported symptoms of nausea, vomiting, weakness, and headache. Some victims reportedly died from internal bleeding. On 5 March 1980 RTA officer in Aranyaprathet delivered the garment sealed in a foil bag to a US Embassy officer. Sample was pouched to USACSL on 7 March 1980	No evidence of any standard CW agent or agent breakdown product was detected on the sample. Two siloxanes (hexamethylcyclotrisiloxane and octamethyltetrasiloxane) were identified. These are of interest because of the intensive studies of siloxanes by Soviet scientists. The presence of a component with a mass of 100 was detected but not identified. No unusual effects were noted in mice confined with the clothing for six hours. Biocultures proved negative.

Table B-2 (Continued)

Kampuchea: Sample Collection and Analysis for Presence of Chemical Warfare Agents

Sample No.	Sample Description	History of Sample	Analytical Results
6	Yellow corn packaged in plastic bag.	Obtained from Kampuchean refugee. Received by USACSL on 19 November 1979.	Arsenic was detected at a level of 43 ppm. Arsenic appears to be organically bound, but is not in a known CW agent structure.
7 *	Water sample from area of CW attack.	Sample given to US Embassy officer by Thai chemical officer who acquired it on the Thai-Kampuchean border area near Phnom Mak Hoeum about 15 March 1981. Sample received by USACSL on 25 March 1981. Sample given to USAMIIA on 26 August 1981 for trichothecene analysis by independent laboratory.	Cyanide at 460 ppm. (Note: control water samples also contained high cyanide levels.) No evidence of standrd CW agents was detected. Analysis for toxins revealed presence of deoxynivalenol at level of 66 ppm. Trace of another trichothecene toxin, diacetoxyscirpenol (DAS), also found.
8 *	Leaves and stem samples.	Sample obtained by Thai chemical officer about 15 March 1981 on Thai-Kampuchean border just south of Phnom Mak Hoeum. Given to US Embassy officer, who sent it to USACSL. Received on 24 March 1981. Transferred to USAMIIA on 29 April 1981 for trichothecene analysis by independent laboratory.	Sample was positive for cyanide (8.7 mg/leaf) and a trace of fluoride. No evidence of standard CW agents. Sample contained three trichothecene toxins: T-2 at 3.15 ppm, nivalenol at 109 ppm, and deoxynivalenol at 59.1 ppm.
9	Water samples	Six water samples reportedly from area of chemical attack were given to Embassy personnel by Thai officer who received them from DK sources. Collected 15 March 1981. Received by USACSL on 24 March 1981.	No evidence of standard CW agents. Not yet analyzed for toxins. Cyanide was found at levels between 210 and 590 ppm. (Note: Cyanide also found in control water samples.)
10	Negative control samples of water, soil, vegetation, corn, and rice.	Received from field on 20 September 1981.	Analyzed for toxins. Negative results on all samples.
11	Blood samples (A14, A15, A16, and A17.)	Four samples were drawn from DK personnel exposed to CW agent on 19 September 1981. Samples drawn on 7 October 1981. Samples were left unrefrigerated for 48 hours after collection and had begun to putrify, which interferes with many assays. Sent to USAMIIA for analysis for trichothecenes at an independent laboratory.	Negative results on all samples. Samples were in poor condition for analysis.
12	Blood samples and blood smears. Total blood samples: 13 (B-1 through B-13)	Nine blood samples from DK personnel who had been subjected to a CW attack in fall 1981. Approximately 50 people were killed in the attack. Four samples from unexposed DK personnel. Samples drawn on 21 October 1981 by trained medical personnel. Sent to USAMIIA for analysis on 22 October 1981. Samples properly refrigerated and in good condition for analysis.	White blood cell count (WBC) was low in all victims but not significantly lower than in nonexposed individuals. A metabolite of T-2 toxin (HT-2) was tentatively identified in the blood of two victims having the lowest WBCs.

~~[illegible]~~

Table B-2 (Continued)

Kampuchea: Sample Collection and Analysis for Presence of Chemical Warfare Agents

Sample No.	Sample Description	History of Sample	Analytical Results
13	Two samples: — Bottle with leaves reportedly contaminated with powder CW agent. — Bottle with small piece of bamboo reportedly contaminated with toxic agent.	Powder spread by airplane over upper Koh Kong Province. Exposed individuals vomited blood. Also some deaths. Attack took place on 10 November 1981. Samples were given to Embassy contacts by DK escape representative in Bangkok on 12 November 1981. Sent 16 November 1981 in diplomatic pouch. Received by USACSL on 19 November. Portion of sample transferred to USAMIIA for trichothecene analysis.	Analysis in progress.
14	Glass bottle containing a powder, tinted pink.	Powder was obtained on 20 November 1981 by KPNLF (Khmer People's National Liberation Front) forces in Kampuchea. Received by USACSL on 8 December 1981. Portion of sample transferred to USAMIIA on 16 December 1981 for trichothecene analysis.	Sample is 98-percent talc. Other chemicals not identified. Analysis for trichothecenes incomplete.

[a] Control samples collected outside range of chemical attack did not contain any trichothecene toxins or known CW agents.

Table B-3

Afghanistan: Sample Collection and Analysis for Presence of Chemical Warfare Agents

Sample No.	Sample Description	History of Sample	Analytical Results
1	Rocket and bomb fragments with Soviet markings.	Fragments were obtained in Konarha Province. Sent to USACSL on 18 April 1980.	No evidence of standard CW agents.
2	Soviet gas mask and canister.	Purchased in Kabul. Sent to USACSL 18 September 1980.	No evidence of standard CW agents. Dioctylphthalate, which probably was used to test gas mask filter, was identified.
3	Knit polyester cap, a polyester knit jacket, badly worn shirt, which appeared to be recently washed.	Obtained in Islamabad, Pakistan, from an Afghan refugee, who claimed he was subjected to a gas attack. Collected on 2 November 1980; shipped from field on 19 November 1980; received by CSL 8 December 1980.	No evidence of any known CW agent. Detected a high molecular weight ester and adipic acid esters which could be indicative of a trichothecene. Also detected malathion.
4	Human tissue (2 bottles)	Same as 3.	Not analyzed because of sample deterioration en route.
5	7.62-mm cartridges.	The cartridges, which reputedly were coated with a poison, were carried by special Afghan police and some Soviet advisers. Samples were collected in November 1980 and received for analysis at USACSL on 4 February 1981.	No evidence of standard CW agents was found on bullet coating or scrapings from slug. Not analyzed for toxins.

Table B-3 (Continued)

Afghanistan: Sample Collection and Analysis for Presence of Chemical Warfare Agents

Sample No.	Sample Description	History of Sample	Analytical Results
6	Cotton garment and socks.	Clothing appeared to be very dirty. Clothing obtained from Afghan refugee in Islamabad, Pakistan. Refugee reportedly subjected to CW attack. Received by USACSL 12 February 1981. Transferred to USAMIIA for toxin analysis.	No evidence of known CW agents. Results on trichothecene pending completion of analysis.
7	Soviet Shlem gas masks.	Five masks were procured in Kabul, Afghanistan, at various times and were sent as received to USACSL for analysis between 24 August 1981 and 21 December 1981. No background information is available with these masks.	No evidence of any known CW agents to date.
8	Soviet 5.45-mm cartridge case, expended.	Obtained by Mujahedin about 1980. The bullets had been captured from the Soviets and used by Afghan Islamic insurgents. During a firefight, insurgents using the bullets became ill, with severe vomiting and nausea for several hours. They suspected that Soviets had contaminated the powder charge. Sent to USACSL on 25 August 1981.	No evidence of any generally recognized agent or toxic compound was found. Was not analyzed for toxins.
9	Soviet gas mask with canister.	Item was reportedly taken from a Soviet who was killed during a Soviet gas attack in early 1981. Item was collected by an Afghan, who is associated with the Mujahedin and who loaned the item to US personnel for analysis. USACSL received the mask on 18 December 1981.	Analysis incomplete.
10	Grain	Sample was collected by a reliable source, who reported that it may have been poisoned. USACSL received sample on 24 February 1982. Portion of sample to be analyzed for toxins.	Analysis incomplete.

ANNEX C [1]

US ARMY SURGEON GENERAL'S INVESTIGATIVE TEAM REPORT

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Use of Chemical Agents Against the H'Mong in Laos

From 28 September to 12 October 1979 a team from the office of the US Surgeon General was in Thailand to investigate allegations of the use of chemical agents against H'Mong tribesmen in Laos.

The team visited the following H'Mong refugee camps in northern Thailand: the detention center at Nhong Khai; the large H'Mong camp at Ban Vanai; and two smaller camps at Nam Yao and Mae Charmin. As the great majority of refugees as well as the H'Mong leadership are at Ban Vanai, most of the interviews were obtained there.

Entrance and exit briefings concerning the team's mission were held at the US Army Biomedical Laboratory, Aberdeen Proving Ground; the State Department, Washington; and the US Embassy, Bangkok; and with the Thai Army Surgeon General; refugee camp officials; and the US Army Surgeon General and Assistant Chief of Staff for Intelligence.

The team was prepared to obtain blood and skin samples (for cholinesterase activity and study of pathological changes, respectively) from those exposed to chemical agents. For such samples to yield meaningful results they must be taken within six to eight weeks of exposure. Since the last reported exposure was in May 1979, no samples were collected.

Interviews were conducted through interpreters; one interpreter was an employee of the US Consulate at Udorn, and the remainder were hired from among the refugees. The interpreters screened those refugees who volunteered to talk to the team and selected only those who had been eyewitnesses to or had themselves been exposed to an agent attack. Team members interviewed 40 men, two women, and a 12-year-old girl. Each interview took one to two hours. To achieve conformity a prepared questionnaire was used as a guide.

The chemical attacks reportedly occurred between June 1976 and May 1979 (table C-1). The absence of reports of attacks after May 1979 may be because very few refugees crossed the Mekong River after that time because of heavy rains and flooding from June to September 1979. Most of the early reports were of the use of rockets releasing the agent, but beginning in the fall of 1978 the majority of the attacks were carried out by aircraft spraying a yellowish substance which "fell like rain." The sites of the attacks, which were concentrated around the H'Mong stronghold in the mountainous Phou Bia area, are also listed in table C-1

[1] This annex is unclassified.

Table C-1

Reports of Probable Chemical Agent Attacks

Date	Location	Method of Attack	Material Used (Smoke or Gas)
Jun 76	Pou Mat Sao	Plane, rockets	Red and green
Jan 77–Oct 78	Pha Khao	Plane, rockets	Yellow, red, green
Mar 77	Nam Theuna	Plane, rockets	Red and yellow
Apr 77	Houi Kam Lang	Plane, rockets	Yellow
May 77	Pha Khae	Plane, rockets	Red
May 77	Nam Moh	Plane, rockets	Yellow
May 77	Pha Ngune	Biplane, spray	Yellow gas
		Plane, rockets	Yellow
1977-78x3	Phu Seu	Plane, rockets	Red, green, yellow
Jan 78	Houi Xang	Plane, rockets	Red and green
Feb 78	Sane Mak Ku	Plane, rockets	Yellow
Feb 78	Tham Se Sam Lein	Plane, rockets	Yellow and black
Feb 78	Kio Ma Nang	Plane, rockets	Yellow
Mar 78	Mouong Ao	Plane, rockets	White
Mar 78	Khieu Manang	Plane, rockets	Green
Apr 78	Tha Se	Plane, rockets	Yellow
Jun 78	Pha Phay	Plane, rockets	Yellow
Jun 78	Phou Seng	Plane, rockets	Red, white, black
Jul 78	Phou Bia	Plane, rockets	Red
Jul 78	Ban Nam Mo	Plane, spray	Yellow
Jul 78	Phou Lap	Plane, rockets	Yellow
Aug 78	Pha Houai	Plane, rockets	Red and green
Aug 78	Ban Thin On	Plane, rockets	Green and red
Aug 78	Bouam Long	Plane, rockets	Red, green, yellow
Sep 78	Pha Koug	Plane, rockets	Yellow
Sep 78	Ban Nam Tia	Plane, spray/rockets	Yellow, green, red
Sep 78	Pha Na Khum	Plane, rockets	Red
Oct 78	Phou Bia	Plane, rockets	
Oct 78	Ban Done	Plane, spray	Yellow
Oct 78	Phou Bia	Plane, rockets	White, green, red
Nov 78	Phou Chia	Plane, rockets	White, red
Feb 79	Pha Mat	Plane, spray	Yellow
Feb 79	Tong Moei	Plane, rockets	Yellow and red
Mar 79	Pha Mai	Plane, spray	Yellow
Apr–May79x4	Pha Mai	Plane, spray	Gray-white
Mar–May79x6	Pha Mai	Plane, spray	Yellow
May 79	Phou Chia	Plane, spray	Yellow
May 79	Moung Phong	Plane, rockets	Red

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Oct 77	Phu Hay, S of Phu Bia	Plane (L-19), rockets	Yellow-gray gas
Unk 78	Pa Sieng, S of Phu Bia	Plane, unknown bomb	Yellow cloud
Feb 78	Ban Nam Luk S of Phu Bia	Planes (L-19) spray (?)	Yellow/white gas
Feb 78	20 km SE of Phu Bia	Plane, unknown spray (?)	Yellow, provided sample
Feb 78	Ban Ko Mai	Plane, unknown bomb	Yellow
Mar 78	Pha Houei	Plane (MIG?), sacks burst in air	Brown gas

Table C-1 (Continued)

Reports of Probable Chemical Agent Attacks

Date	Location	Method of Attack	Material Used (Smoke or Gas)
Mar 78	Ban Na Pong	Plane (jet?), not described	Yellow
Apr 78	Ban Phamsi	Plane, not described	Green and white cloud
May–Apr 78	Ban Nong Po	Plane (MIG?), cloud	Yellow-brown like rain
Jun 78	Ban Nam Teng	Plane, unknown rocket (?)	Yellow gas
Jun 78–May 79	Ban Don area	Plane (jet?), spray	Yellow rain
Mid-78	1-3 km NE of Phu Bia	Plane, unknown rocket, burst in air	Red gas
Oct 78	Nam Kham	Plane (L-19), rockets, airburst	Yellow cloud
Oct 78	6 km N of Phou Khao	Plane (L-19?), rockets, airburst	Red cloud
Oct 78	3-4 km N of Phu Bia	Plane (L-19?), rockets, airburst	Yellow-gray fog
Nov 78	Phou Xang Noi	Plane (MIG?), spray	Yellow and blue cloud
Nov 78	nr Phu Bia	Plane, unknown bomb, airburst	Yellow substance
Nov 78	NE of Pha Khao	Plane (L-19), rocket, airburst	Yellow gas
Apr 79	Ban Nouia Pong	Plane (MIG?), spray	Yellow clouds
May 79	Nam Po	Plane (jet?), spray	Yellow substance
May 79	Pha Mai	Plane (MIG?), spray, airburst	Yellow substance

The team was given a plastic vial containing pieces of bark stained by a yellow substance which several H'Mong refugees claimed was residue from an aircraft spray attack in April 1979. Preliminary chemical analysis of the sample indicates that no standard chemical agent is present, i.e., an agent listed in TH 8-285 (US Army, May 1974). A complete report of this analysis will be submitted upon completion of further studies.

A similar series of interviews was conducted by State Department officials in June 1979. From the signs/symptoms described and observed the following is suggested:

1. At least two, and possibly three, different chemical agents may have been used, such as:

   (a) A nerve agent (five or six individuals reported symptoms that could be attributed to a nerve agent).

   (b) An irritant or riot control agent (a third of the interviews).

   (c) Over half of the interviews indicated such a variety of signs and symptoms that it is difficult to attribute them to a single known agent.

2. It is possible that, in some cases, two or more agents were combined.

   (a) Reported signs and symptoms suggesting a nerve agent include sweating, tearing, excessive salivation, difficulty in breathing, shortness of breath, nausea and vomiting, dizziness, weakness, convulsions, and death occurring shortly after exposure.

   (b) Reported signs and symptoms suggesting a riot control or irritant agent include marked irritation or burning of the eyes with tearing and pain; irritation and burning of the nose and throat; coughing, burning, and tightness in the chest; headache; and nausea and vomiting in a few cases.

   (c) Reported signs and symptoms not related to any known single agent include a mixture of the above plus the features of profuse bleeding from mucous membranes of the nose, lungs, and gastrointestinal tract with rapid death of the affected individuals in some instances. Many of these effects were similar to those described in attacks during the war in Yemen.[1]

[1] SIPRI The Problem of Chemical and Biological Warfare, Volume 5. The Prevention of CBW, page 255. Humanities Press, Inc., 300 Park Avenue South, New York, N Y 10010

Estimates from the H'Mong interviewed indicate that approximately 700 to 1,000 persons may have died as a result of the use of chemical agents, and that many times this number were made ill. It was reported that on numerous occasions entire villages were devastated by these agents, leaving no survivors.

In the episodes described, most of the animals exposed to the chemical agents were killed. Generally, all chickens, dogs, and pigs died and, to a lesser extent, the cattle and buffalo.

On several occasions it was reported that where these agents settled on tree and plant leaves, many small holes appeared in the leaves within two or three days. Rarely did agent exposure result in the defoliation or death of the plants.

Conclusions

The conclusions of the team based upon interviews obtained from H'Mong refugees are as follows:

1. Chemical agents have been used against the H'Mong.
2. The reported effects of these agents suggest the use of a nerve agent, a riot control agent, and an unidentified compound or combination of compounds.

ANNEX D [1]

ANALYSIS AND REVIEW OF TRICHOTHECENE TOXINS

I. SAMPLE ANALYSES FOR TRICHOTHECENES

The Trichothecene Hypothesis

Since 1976, remarkably consistent reports detailing chemical attacks in Southeast Asia have been received by the Intelligence Community. Some of these reports were of particular interest in that they described the use of lethal agents producing symptoms that could not be correlated with those produced by traditionally recognized chemical warfare agents or combinations of them. Table D-1 is a compilation relating the signs and symptoms reported in Laos, Kampuchea, and Afghanistan with symptoms associated with certain chemical agents. The frequency with which a particular symptom was reported is expressed as a percentage of the total number of attacks.

It is readily apparent that the symptoms most frequently described in Laos and Kampuchea correspond most closely with those produced by a group of mycotoxins, the trichothecenes. A review of the scientific literature revealed not only that these compounds had physical and chemical properties indicating potential as chemical agents, but also that they were the subjects of intensive investigation by Soviet scientists at institutes previously linked with chemical and biological warfare research. In the fall of 1980 the trichothecenes were added to the list of agents suspected to have been used in Southeast Asia and Afghanistan. Other candidates under consideration included phosgene oxime, arsines, cyanogen, nerve agents, riot control agents, and combinations of these agents.

Numerous samples from chemical attacks in Laos and Kampuchea were examined at the Chemical Systems Laboratory (CSL) for the presence of traditional chemical warfare agents and were reported to be negative. In March 1981 CSL reported the presence of an unusual compound ($C_{15}H_{24}$) in the vapor analyses from several clothing and tissue samples taken from the victim of a chemical attack. The compound was very closely related in structure to the simple trichothecenes, and this finding sparked the request for analysis of all future samples for the presence of trichothecene mycotoxins.

The Kampuchean Leaf and Stem Sample—The First Analysis for Trichothecenes

On 24 March 1981 a number of samples from the US Embassy in Bangkok were received. Two of the samples were reported to have been collected from the site of a chemical attack that occurred in the vicinity of TV 3391, an area just south of Phnom Mak Hoeum. A vegetation sample and a water sample were collected within 24 hours of the attack. Examination of bodies of victims of this attack by medical personnel revealed highly unusual degeneration of the mucosal lining of the gastrointestinal tract. The effects described paralleled those known to be produced by the trichothecenes.

The samples were submitted to Chemical Systems Laboratory for analysis for the presence of chemical warfare agents. No evidence of known chemical warfare agents was found. An initial test for the trichothecenes by thin layer chromatography (TLC) was inconclusive because of severe problems with interfering substances and the lack of appropriate standards. The trichothecenes are difficult to detect even under ideal circumstances, and the presence of interfering substances in the sample may make identification and quantitation by TLC inconclusive. A review of the limitations and potentials of analytic methods for trichothecenes led to the conclusion that the computerized gas chromatography/mass spectroscopy method in the selected ion monitoring mode would enable precise identification and quantitation of these com-

[1] This annex is unclassified.

Table D-1

Symptoms of Chemical Attacks Reported in Laos, Kampuchea, and Afghanistan

Symptom	Percentage of Reports Mentioning Symptom	Tricho-thecenes	Nerve Agents	Arsines	Phosgene Oxime	Cyano-gens	Incapitant	Riot Control Agents
Laos								
Multiple deaths	84.6	X	X	X	—	X	—	—
Vomiting	71.4	X	X	X	—	—	—	X
Diarrhea	53.1	X	X	X	—	—	—	—
Hemorrhage	52.0	X	—	—	X[a]	—	—	—
Breathing difficulty	47.95	X	X	X	X	X	X	X
Itching and skin irritation	43.9	X	—	X	X	—	—	X
Nausea	42.8	X	X	X	—	—	X	X
Animal death	41.8	X	X	X	—	X	—	—
Blurred vision	39.7	X	X	X	X	X	X	X
Headache	36.7	X	X	—	X	—	X	X
Fatigue	35.7	X	X	—	—	—	X	—
Nasal excretion	34.7	X	X	X	X	—	—	X
Rash or blisters	32.6	X	—	X	X	—	—	X
Tearing	30.6	X	X	X	X	X	—	X
Coughing	28.6	X	X	X	X	X	—	X
Effect on Vegetation	26.5	X	—	—	X	—	—	—
Dizziness and vertigo	25.5	X	X	—	—	X	X	X
Facial edema	20.4	X	—	X	X	—	—	X
Thirst and dry mouth	20.4	X	—	—	—	—	X	—
Skin color change	16.3	X	—	—	X	—	—	—
Tachycardia	12.3	X	X	—	X	X	X	X
Temporary blindness	9.18	X	—	X	X	—	X	X
Rapid loss of consciousness	9.18	X[b]	X	—	—	X	X	—
Salivation	6.12	X[c]	X	—	—	—	—	—
Hearing loss	5.1	X	—	—	—	—	—	
Tremors or convulsions	4	X	X		X	X		
Sweating	3	—	X					
Paralysis	3	X	X	—	—	X	—	
Loss of appetite	3	X	X	X	—	—	—	
Frequent urination	2	X	X					
Kampuchea								
Multiple deaths	72.4	X	X	X	—	X	—	
Hemorrhage	62.06	X	—	—	X[d]	—	—	—
Dizziness and vertigo	51.7	X	X	—	—	X	X	X
Vomiting	41.3	X	X	X	—	—	—	X
Nausea	34.5	X	X	X	—	—	X	X
Skin irritation	27.6	X		X	X	—	—	X
Rapid loss of consciousness	24.1	X[b]	X	—	—	X	X	
Fever	20.68	X	—	—	—	—	—	—
Headache	17.2	X	X		X		X	X
Tearing	13.8	X	X	X	X	X	X	X
Breathing difficulty	13.8	X	X	X	X	X	X	X
Fatigue	13.8	X	X	—	—	—	X	
Paralysis	10.3	X	X			X	—	
Numbness	6.9	X	X			X	X	

Table D-1 (Continued)

Symptoms of Chemical Attacks Reported in Laos, Kampuchea, and Afghanistan

Symptom	Percentage of Reports Mentioning Symptom	Tricho-thecenes	Nerve Agents	Arsines	Phosgene Oxime	Cyano-gens	Incapitant	Riot Control Agents
Blurred vision	6.9	X	X	X	X	X	X	X
Dry throat and thirst	6.9	X	—	—	—	—	X	—
Edema	6.9	X	—	X	X	—	—	—
Salivation	3.4	X[c]	X	—	—	—	—	—
Vegetation affected	3.4	X	—	—	—	—	—	—
Diarrhea	3.4	X	X	X	—	—	—	—
Cough	3.4	X	—	X	X	X	X	X
Nasal discharge	3.4	X	X	X	X	—	—	X
Rash or blister	3.4	X	—	X	X	—	—	X
Chills	3.4	X	—	—	—	—	—	—
Hearing loss	3.4	X	—	—	—	—	—	—
Afghanistan								
Rapid loss of consciousness	47.9	X[b]	X	—	—	X	X	—
Skin irritation and itching	31.5	X	—	X	X	—	—	X
Multiple deaths	30.1	X	X	X	—	X	—	—
Nausea	20.5	X	X	X	—	—	X	X
Vomiting	19.1	X	X	X	—	—	—	X
Tearing	17.8	X	X	X	X	X	—	X
Dizziness and vertigo	16.4	X	X	—	—	X	X	X
Blisters or rash	15	X	—	X	X	—	—	X
Difficulty breathing	13.7	X	X	X	X	X	X	X
Paralysis	13.7	X	X	—	—	X	—	—
Headache	12.3	X	X		X		X	X
Temporary blindness	8.2	X	—	X	X		X	X
Salivation	6.8	X[c]	X	—	—	—		—
Loss of appetite	6.8	X	X	X	—	—		—
Effects on vegetation	5.5	X		—	—			
Fatigue	5	X	X	—			X	—
Confusion	4.1	X	X	—	—	—	X	—
Hemorrhage	4.1	X	—	—	X[a]	—	—	—
Change in skin color	2.8	X	—	—	X	—	—	—
Diarrhea	2.8	X	X	X	—	—	—	—
Coughing	1.3	X	X	X	X	X	X	X

[a] Bloody frothing.
[b] Only at very high doses.
[c] Depending on which trichothecenes.
[d] Blood-flecked frothing.
[e] Depending on compound

pounds in complex mixtures. An additional recent publication includes a summary of the currently available methods suitable for trichothecene analysis and an assessment of their utility and limitations.

A portion of the leaf and stem sample was furnished to the US Army for further analysis. This sample (see table D-2, group I/A), a positive control sample to which T-2 toxin was added (group I/B), and a negative control sample of similar vegetation (group I/C) were forwarded to Dr. Chester J. Mirocha, Department of Plant Pathology, University of Minnesota. Dr. Mirocha was given no information concerning the history or content of the samples, and was requested to analyze the three unknowns for the presence of trichothecene toxins using the best methods at his disposal. Briefly, the analysis involves a series of extractions followed by ferric gel separation, selected ion monitoring on a computerized gas chromatograph/mass spectrometer, and a full mass spectral scan for comparison with known standards.

The methods used are among the most sensitive and specific for detection of these compounds; also, false positives are rare. Toxins can be identified by their mass spectra and quantified with a high degree of accuracy. Group I/A—the vegetation sample allegedly exposed to a CW agent—was found to contain 109

Table D-2

Trichothecene Sample Analyses

Reference Number/ Case Number	Code	Date Received	Description	Current Status
Sample Group I/................ M-22-81		29 Apr 81	Leaf and stem + negative control	Analysis complete.
	A		Sample from attack area	Code A sample: T-2 - 3.15 ppm; Nivalenol - 109 ppm; Deoxynivalenol - 59.1 ppm
	B		Positive control (spiked)	Code B sample: T-2 - 35.7 ppm; Nivalenol - 21.7 ppm
	C		External negative control	Code C sample: Negative results
Sample Group II/.......... M-23-81		26 Aug 81	Environmental samples	Analysis complete.
	D		Water	Code D sample: Deoxynivalenol - 66 ppm; Diacetoxyscirpenol - Trace
	E *		Yellow powder	Code E sample: T-2 - 150 ppm; Diacetoxyscirpenol - about 25 ppm
	F		Speck (unknown substance)	Code F sample: Diacetoxyscirpenol - 10 ng
Sample Group III/............ M-26-81		20 Sep 81	Environmental samples (Negative controls)	Analysis complete.
	A		Water sample	Negative results on all samples tested to date.
	B		Soil sample	
	C		Soil sample	
	D		Dried corn	
	E		Rice	
	F		Leaves and stem	
	G		Leaves and stem	
	H		Leaves and stem	
	I		Leaves and stem	

Table D-2 (Continued)

Trichothecene Sample Analyses

Reference Number/ Case Number	Code	Date Received	Description	Current Status
Sample Group IV/............. M-1-82		5 Oct 81	Environmental samples (Negative controls)	Retained at laboratory pending results of higher priority analyses.
Sample Group V/.............. M-2-82		11 Oct 81	Blood samples	Analysis complete.
	A14 A15 A16 A17			Negative results on all samples tested to date.
Sample Group VI/............. M-3-82		22 Oct 81	Blood samples	Analysis complete. Analytical findings to date have tentatively identified HT-2, a deacetylated metabolite of T-2 toxin, in the blood of patients 3 and 4 (see table D-3).
	A1 . . . A13			Medical laboratory evaluation of blood samples conducted by US Army Medical Research Institute of Infectious Diseases (USAMRIID).
	B1 . . . B13			No significant statistical differences between control samples from alleged victims of "yellow rain," but a trend toward low blood cell counts in victims was noted. See table D-3.
Sample Group VII/...........		17 Nov 81	Blood samples	Retained at laboratory pending completion of higher priority analyses.
Sample Group VIII/.......... M-8-82		17 Nov 81	Environmental samples	Analysis in progress.
Sample Group IX/............. M-9-82		6 Nov 81	Environmental samples (Sock, pants, mask, water)	Analysis in progress.
Sample Group X/.............. M-11-82		19 Nov 81	Environmental sample	Analysis complete
	E2		Yellow powder	143 ppm T-2 27 ppm DAS 0 nivalenol 0 deoxynivalenol

• Additional 25 mg of this sample was provided to laboratory for analysis for nivalenol and deoxynivalenol (see Sample Group X/M-11-82) parts per million (ppm) of nivalenol, 59.1 ppm of deoxynivalenol, and 3.15 ppm f T-2 toxin; each is a potent toxin of the trichothecene group. No trichothecenes were detected in the negative control sample (group I/C), and 35 ppm of T-2 toxin were detected in group I/B—the sample to which T-2 toxin had been added. It was Dr. Mirocha's assessment that a mixture of these particular toxins in the high levels detected could not have occurred as a result of natural contamination.

The possibility that the identified toxins were produced by natural fungal contamination is addressed in section III. In summary, the possibility was discounted on the basis of the climatic conditions required for production of T-2 toxin, the high levels of toxins detected, the unusual mixture of toxins found, and the results of surveys of Southeast Asia for the presence of these toxins. This conclusion was supported by the analysis of normal flora samples from Kampuchea described below.

Analyses of Control Samples From Kampuchea for the Presence of Trichothecenes

On 20 September 1981, nine control samples were received from US Army personnel in Bangkok, Thailand, for the purpose of conducting laboratory analyses for background levels of trichothecene toxins. The samples were collected from an area near TV 3391 that had not been subjected to any reported chemical attacks. The samples were collected by US personnel under instructions to reproduce the sampling conditions, handling, packaging, and transfer conditions of the original sample as closely as possible. The same species of plant was sampled, and three other vegetation samples were also collected. A water sample as well as two soil samples were recovered. Samples of corn and rice from the area were also taken. These grains provide an ideal substrate for growth of toxin-producing fungi and would therefore be a sensitive indicator of any natural occurrence.

The nine samples were forwarded under code to Dr. Mirocha for trichothecene analysis. A portion of each sample was also submitted to CSL for background determinations of CN^-, Cl^-, and Fl^- levels. No trichothecenes were detected in any of these samples (group III/A-I), indicating that nivalenol, deoxynivalenol, T-2, and diacetoxyscirpenol are not prevalent in the geographical area from which the alleged CW-exposed sample was collected. The appearance of these trichothecenes in high levels and unique combinations in a sample associated with a chemical attack producing symptoms typical of trichothecene exposure indicates that these toxins may have been used as chemical weapons. This conclusion is further supported by the confirmatory evidence provided by the analysis of additional alleged CW samples from Laos and Kampuchea, which are described below.

Analysis of Additional CW Samples From Laos and Kampuchea for the Presence of Trichothecenes

Chemical Systems Laboratory provided three additional suspected chemical warfare samples for analysis for trichothecenes. The first sample (group II/D) consisted of 10 milliliters of water taken from the same chemical attack site in Kampuchea as the leaf and stem sample previously examined (group I/A). The second sample (group II/E) came from the site of a "yellow rain" attack occurring on 13 March 1981 in the village of Muong Cha in the Phou Bia region of Laos. The agent was sprayed from a twin-engine propeller aircraft. The falling substance was described as "like insect spray" and sounded like drizzling rain. It was quite sticky at first, but soon dried to a powder. Symptoms described by victims included nausea, vomiting, and diarrhea. A sample of the agent scraped from the surface of a rock by a victim and carried into Thailand was turned over to US Embassy personnel.

The third sample (group II/F) was taken from the site of a "yellow rain" attack that occurred on 2 April 1981 at Ban Thong Hak in Laos. Twenty-four people reportedly died in this attack and there were 47 survivors. Symptoms included severe skin irritation and rash, nausea, vomiting, and bloody diarrhea. This sample was scraped from the surface of a rock with a bamboo knife by a survivor of the attack. Although the individual took precautions (that is, cloth mask) a severe skin rash and blisters developed.

These three samples were submitted to Dr. Mirocha for analysis. Group II/D (the water sample from Kampuchea) contained 66 ppm of deoxynivalenol and a trace amount of diacetoxyscirpenol (DAS). A trace quantity of group II/E was screened as strong positive for trichothecenes. Further analysis of that sample confirmed the presence of high levels of T-2 toxin (150 ppm) and diacetoxyscirpenol (25 ppm). Interference from phtalate compounds (leached from the plastic packaging) made detection of nivalenol and deoxynivalenol difficult. In a second analysis, the extraction process was modified so that nivalenol and deoxynivalenol could be measured accurately. The analysis showed the presence of 143 ppm T-2 and 27 ppm DAS. No nivalenol or deoxynivalenol was detected. Interestingly, examination of the petroleum ether fraction from sample group II/E revealed the presence of a yellow pigment almost identical to that previously identified by Dr. Mirocha in cultures of *Fusarium roseum*, indicating that the yellow powder probably consisted of the crude extract of a *Fusarium* culture.

There was very little of group II/F contained in the vial received for testing. The quantity was too small to be accurately weighed, and inspection of the vial revealed only a very small speck estimated to weigh much less than 0.1 milligram. That speck contained 10 nanograms of diacteoxyscirpenol, a level equivalent to 100 ppm at the very least and probably much higher. The sample size was too small to allow adequate analysis for the other three trichothecenes of interest.

These results, in general, support the hypothesis that trichothecenes have been used as chemical warfare agents in Laos and Kampuchea. The presence of these high levels of trichothecene toxins in water and in yellow powder scraped from rocks argue against natural occurrence, since neither water nor rock is a suitable environment for growth of the fungi required to produce the toxins.

Differences between the analyses of the Kampuchean leaf and stem sample and the water sample collected from the same attack site raise additional questions. The failure to find T-2 toxin in the water sample is probably due to the relative insolubility of T-2 toxin in water. The presence of DAS in the water might be the result of biotransformation or breakdown of T-2, as they are so structurally similar, differing only in the substitution on carbon 8. While this hypothesis cannot be entirely ruled out, it is unlikely on the basis of known biotransformation of T-2 in the laboratory. The initial vegetation sample was not screened for DAS, though the mass spectra from the initial analysis will be reexamined for trace amounts of DAS.

The absence of nivalenol in the water sample is more difficult to explain because nivalenol is water soluble. The effect of environmental conditions and microorganisms on the stability of these compounds may vary widely for each of the specific compounds and may explain the analytical results. Further scientific investigation of these factors is needed.

II. ANALYSIS OF BLOOD SAMPLES FROM CHEMICAL ATTACK VICTIMS

Blood samples drawn from victims of recent chemical attacks have been received for analysis for indications of trichothecene exposure. Little is known concerning the rate of metabolism of trichothecenes in humans; it is difficult, therefore, to estimate the probability of detection of trichothecenes or their metabolites in blood samples. T-2 is rapidly cleared from the blood in animals, and 25 percent of the total dose is excreted within 24 hours after exposure; therefore, it is unlikely that trichothecenes could be detected unless samples were obtained within 24 to 48 hours after an attack. Other blood parameters are affected by the trichothecenes, however, and may prove to be useful markers. The trichothecenes induce a severe leukopenia (decrease in white cell count) which can persist for several weeks following exposure. In addition, the trichothecenes affect some liver and kidney function marker enzymes which can be monitored in the blood.

On 11 October 1981, four whole blood samples and four blood smears were received from the US Embassy, Bangkok. The blood was drawn from four DK soldiers on 7 October inside Kampuchea. Detailed medical histories as well as descriptions of the attack were recorded on each individual from whom a blood sample was taken. All four men were victims of a gas attack occurring in the fall of 1981 near Takong. Symptoms experienced included vomiting, blurred vision, bloody diarrhea, difficulty breathing, dry throat, loss of consciousness, frontal headache, tachycardia, and facial edema. Unfortunately, the samples could not be refrigerated until 48 hours after collection. It was therefore not possible to obtain data concerning white cell counts and blood chemistry. The four whole blood samples were submitted to Dr Mirocha for analysis for trichothecene metabolites because of the possibility (admittedly remote) that some of the metabolites may bind to blood proteins and may still be detectable even three weeks after an attack. These analyses are reported as group V A14–A17 in table D-2.

On 22 October 1981 additional blood samples were received. These had been drawn from nine victims from a 19 September attack and from four control individuals of similar age and background who had not been exposed to a chemical attack. The samples had been properly refrigerated and were accompanied by very complete and detailed medical histories taken by trained medical personnel who examined the individuals. Included in the package were blood smears and heparinized and nonheparinized samples from each individual. The samples were submitted to US Army Medical Research Institute of Infectious Diseases (USAMRIID) for blood assays. These results are reported in table D-3.

The results show no statistically significant differences between exposed and control groups (students T-test). A trend toward depressed white cell counts in eight individuals exposed to chemical agent was observed. Such an observation would be compatible with the clinical picture of toxin exposure; however, it is also compatible with a number of other medical problems and a larger control sample would be required before such results could be adequately interpreted. Abnormal liver and kidney functions were not indicated by the data.

Portions of these blood samples were analyzed by Dr. Mirocha for presence of trichothecenes and/or trichothecene metabolites. The results of those analyses are consistent with trichothecene exposure in at least two of the gassing victims and tend to support the hypothesis that a trichothecene-based agent was used in this attack.

Using the selected ion-monitoring gas chromatography/mass spectroscopy analysis technique, Dr. Mirocha was able to identify tentatively a metabolite of T-2 toxin (that is, HT-2) in the blood of two alleged victims. The compound was identified on the basis of its selected ion masses and gas chromatographic retention times.

The tentative identification of HT-2 in the blood of two victims, and the *trend toward depressed white cell counts* in these same victims, *cannot be taken as conclusive scientific proof of toxin exposure* because the trace amount of the compound present precluded unequivocal identification and quantitation, and also because many other medical problems in addition to toxin exposure can cause a decrease in white cell counts. It is interesting to note that the individual who showed the greatest amount of the compound tentatively identified as HT-2 in his blood, was reported to have received the greatest exposure to the agent and also had the lowest white blood cell count. He was exposed to contaminated water for more than 30 minutes and was the only victim who fell down in the water and actually swallowed some of it. However, the description by victims of symptoms correlating exactly with those associated with trichothecene poisoning provide strong circumstantial evidence that trichothecenes were used as chemical agents in yet another chemical attack in Southeast Asia.

Trichothecenes have been identified previously in environmental samples taken from several other chemical attacks in Laos and Kampuchea. Analysis of control vegetation, water, soil, corn, and rice samples from these areas, as well as reviews of published scientific literature, indicate that the particular toxins that have previously been identified are not known to occur naturally in the combinations found and at the levels detected in Southeast Asia. The latest analysis results contribute another piece of evidence to the growing body of data supporting the charge that trichothecenes have been used as chemical/biological agents in Southeast Asia.

III. OVERVIEW OF NATURAL OCCURRENCE AND SIGNIFICANT PROPERTIES OF TRICHOTHECENES

Historical Trichothecene Mycotoxicoses

The trichothecenes are members of a large group of naturally occurring toxins known as mycotoxins. The word "mycotoxin" is derived from the Greek "mykes" meaning fungus and the Latin "toxicum" meaning poison. It refers to a metabolite produced by a mold that is toxic to man or animals. Mycotoxicoses have been described as the "neglected diseases" and, before 1960, little English-language literature concerning the diseases caused by mycotoxins was available. Interest

Table D-3

Peripheral Blood Hemograms of Kampuchean Victims of Chemical Attack

Patient No.	RBC [a]	Hgb [b]	Hct [c]	WBC [d]	Retic [e]	MCV [f]	MCH [g]	MCHC [h]
1	specimen clotted							
2	4.46	12.6	37	4,700	1.0	84	28.5	34
3	4.90	11.8	40	5,700	0.4	81	26	32
4	4.90	10.3	34	1,700	2.1	70	21	30
5	4.92	15.0	46	5,300	1.2	93	32	34
6	4.04	12.6	37	4,300	0.8	93	31	34
7	4.88	15.6	46	3,000	0.5	94	32	34
8	5.56	17.0	50	8,700	1.5	91	31	34
9	4.88	11.2	35	5,000	1.0	73	23	32
Controls:								
10	6.23	12.5	41	7,200	0.8	66	20	30
11	4.47	11.9	38	8,000	0.9	85	26.5	31
12	4.88	12.9	41	5,100	2.0	85	26.5	32
13	5.16	15.6	46	6,500	1.0	90	30.5	34
Normal range:								
Male	4.5-6.0	14-18	40-54	7,400		80-94	27-32	33-38
Female	3.5-5.0	12-16	37-47	±2,000				

	BUN [i]	Creatinine	SGPT [j]	Alkaline Phosphatase
1	9.0	3.5	48	132
2	8.5	0.8	36	47
3	8.0	1.4	12	75
4A	11	1.3	6	94
4B	10.5	1.2	6	68
5	6.0	1.6	12	84
6	7	1.2	18	115
7	8.5	1.7	6	69
8	10	1.5	36	79
9	12.5	1.4	12	70
10	10.5	1.8	12	86
11	12	0.8	24	74
12	12	1.4	6	76
13	9.0	1.2	30	102
Normal Range				
Male	7-20	0.4-1.7	6-37	24-69
Female				23-71

[a] Red blood cells x10^{-6} (#/cc)
[b] Hemoglobin (gm/100cc)
[c] Hematocrit (%)
[d] White blood cells (#/cc)
[e] Reticulocytes (#/cc)
[f] Mean corpuscular volume (μ^3)
[g] Mean corpuscular hemoglobin ($\mu\mu g$)
[h] Mean corpuscular hemoglobin concentration (%)
[i] Blood urea nitrogen (mg%)
[j] Serum glutamic pyrovic transaminase

ingly, the first comprehensive studies of mycotoxin diseases were conducted in the Soviet Union in the late 1930s. Thus, Soviet scientists have been involved in research with some of these compounds for almost 30 years longer than their Western counterparts (see section V of this annex). The Soviet Union has had serious problems with mycotoxin contamination of food and has suffered several severe outbreaks of disease in humans.

The group of mycotoxins that has figured most prominently in Soviet scientific literature since the 1940s are the trichothecenes. They are a group of chemically related, biologically active fungal metabolites produced primarily by various species of *Fusarium*. Table D-4 lists some of the toxins in this group and producing fungi. The fungi are well-known plant pathogens that frequently invade numerous agricultural products.

Trichothecene toxins, perhaps more than any other mycotoxins, have been associated with acute disease in humans. Most of the human intoxications occurred in the Soviet Union (table D-5). The earliest recognized outbreak occurred in 1891 in the Ussuri district of eastern Siberia. Humans who consumed contaminated grain exhibited headache, chills, nausea, vomiting, vertigo, and visual disturbances. Dogs, horses, pigs, and domestic fowls were reported to be affected.

The most extensive mycotoxicosis outbreak, reported to have caused multiple fatalities in man, also occurred in the Soviet Union. In 1944, 30 percent of the population of Orenburg was affected by alimentary toxic aleukia or ATA, a disease later shown to be due to ingestion of trichothecene toxins. Over 10 percent of the entire population of the Orenburg district died of the disease. Numerous other outbreaks of ATA occurred in the Soviet Union, primarily between the years 1942 and 1947. The contamination was traced to overwintered millet, wheat, and barley infected with *Fusarium*. Symptoms of the disease included vomiting, skin inflammation, multiple hemorrhaging (especially of the lung and gastrointestinal tissue), diarrhea, leukopenia, and suppression of bone marrow activity.

In 1939, Nikita Khrushchev was dispatched to the Ukraine region of Russia by Premier Joseph Stalin to organize and improve agricultural operations and to identify the disease that was causing the deaths of many horses and cattle. The problem was traced to hay and straw contaminated with ***Stachybotrys atra***. The disease, later referred to as stachybotryotoxicosis, occurred after ingestion or contact with the contaminated grain. Symptoms included ulcerative dermatitis, perioral dermatitis, blood dyscrasias, hemorrhagic syndromes, abortion, and death. The greatest economic impact was due to loss of horses, but cattle, sheep, poultry, and humans were also affected.

Other disease outbreaks in which similar symptoms were exhibited occurred in 1958 and 1959 among

Table D-4

Trichothecene-Producing Fungi

Type	(A) T-2 Type	(B) Nivalenol-Type	(C) Macrocylic
	T-2 toxin	Nivalenol	Roridins
Trichothecenes	HT-2 toxin	Monoavetylnivalenol	Verrucarins
	Diacetoxyscirpenol	Diacetylnivalenol	Satratoxins
	Neosolaniol	Deoxynivalenol	Vertisporin
	F. tricinctum	*F. nivale*	*Myrothecium verrucaria*
Fungus	*F. roseum*	*F. opisphaeria*	*M. roridum*
	F. equiseti	*F. roseum*	*Stachybotrys atra*
	F. sporotrichioides		*Verticimonosporium diffractum*
	F. lateritium		
	F. poae		
	F. solani		
	F. rigidiusculum		
	F. semitectum		

Table D-5

Historical Trichothecene Mycotoxicosis

Toxicosis	Districts and Affected Species	Symptoms
"Taumelgetreide" toxicosis........	USSR Man, farm animals	Headache, nausea, vomiting, vertigo, chills, visual disturbances
Alimentary toxic aleukia............	USSR Man, horse, pig	Vomiting, diarrhea, multiple hemorrhage, skin inflammation, leukopenia, angina
Stachybotryotoxicosis..................	USSR, Europe Horse	Shock, somatitis, hemorrhage, dermal necrosis, nervous disorders
Bean-hull toxicosis	Japan Horse	Convulsion, cyclic movement
Dendrodochiotoxicosis................	USSR, Europe Horse	Skin inflammation, hemorrhage
Moldy corn toxicosis	United States Pig, cow	Emesis, hemorrhage
Red mold toxicosis......................	Japan, USSR Man, horse, pig, cow	Vomiting, diarrhea, congestion, and hemorrhage of lung and intestine

horses and cattle in the Soviet Union and Eastern Europe. Thousands of animals were lost in these outbreaks. Other intoxications were reported subsequently in Japan, Europe, the Soviet Union, and the United States, affecting various domestic animals and—in the case of red mold toxicosis—affecting man. All of these diseases have now been shown to be due to ingestion of trichothecenes rather than to an infectious agent. In earlier disease outbreaks, the levels of toxin present in the contaminated grain was not measured; however, the levels of nivalenol and/or deoxynivalenol measured in toxic grains implicated in more recent outbreaks (that is, "moldy corn toxicosis" and "red mold toxicosis") were typically between 2 and 8 ppm.

Natural Occurrence of Trichothecene Mycotoxins

Publications concerning the occurrence of trichothecenes have been relatively scarce because of the lack of convenient detection methods and the complexity of the trichothecene family of compounds. Only recently have scientists developed methods capable of distinguishing between close structural derivatives and accurately quantitating the levels of toxin present (see table D-6 for comparison of analytical methods). Extreme care must be taken when reviewing the scientific literature on natural occurrence of these compounds, because erroneous conclusions can be drawn on the basis of results obtained with inadequate analytical techniques. Misidentification of compounds and gross overestimation of concentrations have occurred using techniques such as thin layer chromatography as the basis of analysis.

Table D-7 lists the reports of natural occurrence of T-2 toxin, diacetoxyscirpenol, and nivalenol that were obtained from a literature search of over 3,000 citations concerned with trichothecene toxins. Levels that are questionable on the basis of techniques used are indicated. It is immediately apparent that the levels of toxins found in the various samples from Laos and

Table D-6

Physicochemical Methods for Detection of Trichothecenes in Feedstuffs

Method	Trichothecenes Detected	Detection Limits	Required Standards	Use and Limitation
Thin-layer chromatography 1-dimension	All — —	0.1 microgram/spot (H_2SO_4)	Reference Standard	Qualitative Interference Not confirmatory
Thin-layer chromatography 2-dimension	All	0.1-1.0 microgram/spot (H_2SO_4)	Reference Standard	Qualitative Less interference Confirmatory
Gas-liquid chromatography	Nonhydroxylated or TMS derivatives	0.03-0.05 microgram/ microliter injection	Reference Standard	Quantitative Monoglyceride interference Equivocable interference
Gas chromatography/mass spectrometry-normal scanning mode	TMS derivatives	0.02-0.05 microgram/ microliter injection	Reference Standard or Spectrogram	Semiquantitative Less interference Unequivocable identification
Gas chromatography/mass spectrometry-selection ion monitoring	TMS derivatives	0.007-0.02 microgram/ microliter injection	Reference Standard or Spectrogram	Quantitative Best for complex mixtures Unequivocable identification
Nuclear-magnetic-resonance	All	—	Reference Standard or Spectrogram	Confirmatory Purified toxin structure elucidation
Radioimmunoassay (developmental stage)	T-2 toxin	1-20 nanograms	Rabbit anti-T-2 toxin antibody	Sensitive Low interference
			HT-2 toxin	Relative structural specificity

Kampuchea are highly unusual, even if one accepts the questionable reports in table D-7 as valid. The levels of these toxins (150 ppm of T-2 toxin, 109 ppm of nivalenol, more than 100 ppm of diacetoxyscirpenol, and 66 ppm of deoxynivalenol) are markedly higher than those reported to occur in nature.

It should also be noted that the incidences recorded in table D-7 concern levels of toxin produced when *Fusarium* is growing on its ideal substrate, while the Laos and Kampuchea samples were taken from surfaces that would be extremely unlikely to support *Fusaria* growth and toxin production—that is, the surface of rocks and water. Higher levels of toxin production can, of course, be induced when the mold species is grown in pure culture under ideal conditions in the laboratory; for instance, the Soviets have succeeded in producing 4 grams of T-2 per kilogram of substrate. In a natural environment, however, the *Fusaria* species cannot compete well with other molds such as species of *Aspergillus* and *Penicillium*, and, as in table D-7, levels of toxin produced are orders of magnitude lower.

The conclusion that the levels of toxins found in the Southeast Asia samples could have occurred only by means of an unnatural mechanism is also strengthened by surveys of the area conducted by various research-

Table D-7

Spontaneous Occurrence of Trichothecene Mycotoxins

Toxin	Country	Source	Concentration (parts per million)	Reference [a]
T-2:				
	USA	Mixed feed	0.08 [b]	15
	UK	Brewer's grains	ND [c]	19
	India	Sweet corn	4 [b,d]	5
	Canada	Corn	ND	4
	India	Sorghum	ND [d]	22
	Canada	Barley	25 [d]	20
	India	Safflower seed	3-5 [d]	6
	US	Corn stalks	0.11 [b]	16
	US	Feed supplement	ND	7
	US	Corn	2	8
	US	Mixed feed	0.3	14
	France	Corn	0.02 [b]	10
	US	Corn	ND	2
Diacetoxyscirpenol:				
	US	Mixed feed	0.5	15
	US	Mixed feed	0.38	15
	India	Safflower seed	3-5 [d]	6
	India	Sweet corn	14 [d]	5
	Germany	Corn	31.5 [d]	23
	US	Corn	0.88	21
Deoxynivalenol:				
	US	Corn stalks	1.5 [b]	16
	US	Corn	1.8 [b]	15
	US	Corn	1.0 [b]	15
	US	Corn	0.1 [b]	15
	US	Mixed feed	0.04 [b]	15
	US	Mixed feed	1.0 [b]	15
	US	Mixed feed	1.0 [b]	15
	US	Corn	7.4	9
	US	Corn	0.125 [d]	21
	US	Corn	trace-25 [d]	2, 21
	US	Corn	1.1-10.7	26
	US	Corn	41	25
	US	Corn	1.0 [b]	17
	US	Oats	5	17
	Japan	Barley	ND	18
	US	Corn	1.0 [b]	13
	US	Corn	0.06 [b]	13
	US	Mixed feed	0.07 [b]	13
	France	Corn	0.6 [b]	10
	South Africa	Corn	2.5	11
	Zambia	Corn	7.4	11
	US	Corn	ND	2
	Japan	Barley	7.3	18
	Austria	Corn	1.3	24
	Austria	Corn	7.9	24
	Canada	Corn	7.9	24

Table D-7 (Continued)

Spontaneous Occurrence of Trichothecene Mycotoxins

Toxin	Country	Source	Concentration (parts per million)	Reference [a]
Nivalenol:				
	Japan	Barley	ND	18
	France	Corn	4.3 [b]	10
Partially characterized trichothecenes:				
	US	Corn	ND	25
	India	Safflower seed	ND [d]	6
Skin irritant factors—not analyzed chemically:				
	US	Corn	93 positive [b] of 173	3
	US	Corn	Multiple positive samples	21
	Yugoslavia	Corn	16 positive of 191	1

[a] References:

1. Balzer *et al.* (1977)
2. Ciegler (1978)
3. Eppley *et al.* (1974)
4. Funnel (1979)
5. Ghosal *et al.* (1978)
6. Ghosal *et al.* (1977)
7. Hibbs *et al.* (1974)
8. Hsu *et al.* (1972)
9. Isshi *et al.* (1975)
10. Jemmail *et al.* (1978)
11. Marasas *et al.* (1977)
12. Miller (1976)
13. Mirocha (1979a)
14. Mirocha (1979a)
15. Mirocha *et al.* (1976b)
16. Mirocha *et al.* (1979a)
17. Mirocha *et al.* (1979b)
18. Morooka *et al.* (1972)
19. Petrie *et al.* (1977)
20. Puls and Greenway (1976)
21. Romer, T., Ralston Purina, St. Louis, MO (personal communications
22. Rukmini and Bhat (1978)
23. Siegfried (1979)
24. Vesonder and Ciegler (1979)
25. Vesonder *et al.* (1976)
26. Vesonder *et al.* (1978)

[b] Zearalenone (F-2 toxin) also detected in the sample.

[c] ND = toxin concentration was not determined.

[d] Levels that are questionable on the basis of techniques used.

ers. Surveys of the toxigenic fungi and mycotoxins of Southeast Asia conducted by the Mahidol University in Bangkok and the Massachusetts Institute of Technology, have not revealed the presence of T-2, nivalenol, deoxynivalenol, or diacetoxyscirpenol, although other mycotoxins such as aflatoxin, were identified. These results were confirmed by our analysis using our own methodology of normal flora samples of vegetation, soil, water, corn, and rice from Kampuchea that revealed the presence of no trichothecenes.

Skeptics have formulated theoretical explanations for the analytical results to support a hypothesis of natural occurrence of these toxins. It was postulated that the trichothecenes found were absorbed through the roots of a plant, translocated to the leaves, and exuded and washed onto the surface of a rock and into water where they were found. A 1981 publication by Jarvis *et al.* reported a Brazilian shrub that appeared to absorb, translocate, and chemically alter a macrocyclic trichothecene produced by a soil fungi. While this citation is used to support a hypothetical mode for natural deposition in Southeast Asia it should be noted that the plant reported by Jarvis *et al.* did not exude the toxin, that the toxin was extremely phytotoxic to all other plants assessed, and that the plant was not capable of *de novo* trichothecene synthesis. No other trichothecenes have been found to be absorbed and translocated in any other plant in this manner. Control samples of soil and vegetation from Southeast Asia do not support endemic presence of these toxins. The appearance of these particular trichothecene toxins in these high levels in environments generally inhospitable to their formation cannot reasonably be attributed to a natural contamination.

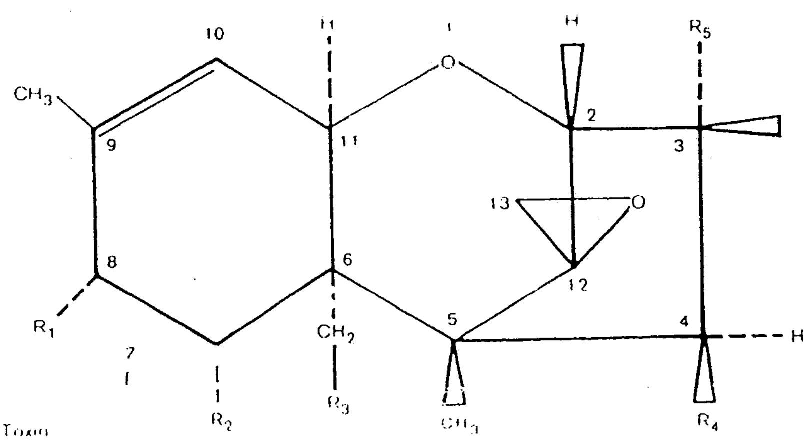
Chemical and Physical Properties of the Trichothecenes

When considering the suitability of trichothecenes as agents, factors such as stability, solubility, and ease of production must be considered. The general structure for the trichothecene group is shown in figure D-1. There are over 40 currently known, naturally occurring, 12, 13 epoxytrichothecenes. The R groups may be hydroxyls, acylated hydroxyl groups, or esters. The R group for the toxins detected in Sample Group I/A are shown below the general structure. All of the compounds have in common an olefinic double bond at carbon atoms 9 and 10 and an epoxy group at carbon atoms 12 and 13. These compounds are stable, especially in the solid form. They may be stored for years at room temperature with no loss of activity. They are heat stable with no loss of activity noted after heating for 1 hour at 100 degrees centigrade. The solubility depends on the R groups; highly hydroxylated derivatives are more water soluble. The compounds are also quite stable in solution. Detoxification can be accomplished by treatment with strong mineral acid, which will open the 12 to 13 epoxide bond and abolish all biological activity. Most of the toxins are well absorbed through mucous membranes and some through skin; this property is also a function of the R group.

Some of these compounds have been synthesized chemically; however, biosynthesis employing Fusarium species is the most effective way to produce large quantities. In a preliminary search of recent Soviet open source literature, 50 articles dealing with the trichothecenes were reviewed. Of these, 22 dealt with defining optimum conditions for biosynthesis of the compounds. N. A. Kostyunina has reported production of T-2 toxin at levels of 4 grams per kilogram of

Figure D-1

General Structure of Trichothecenes



T-2 Toxin	Nivalenol	Deoxynivalenol	Diacetoxyscirpenol (DAS)
$R_1 = O-\overset{O}{\overset{\|}{C}}-CH_2-CH(CH_3)_2$	R_1=O	R_1=O	R_1=H
R_2=H	R_2=OH	R_2=OH	R_2=H
R_3=OAc	R_3=OH	R_3=OH	R_3=OAc
R_4=OAc	R_4=OH	R_4=H	R_4=OAc
R_5=OH	R_5=H	R_5=H	R_5=OH

Unclassified

586192 3-82

substrate (normally wheat grain, or rice). Numerous industrial microbiology plants have been identified in the Soviet Union. Some of these are involved in production of single-cell protein for fodder additives, others produce antibiotics, and the function of still others is unknown. As published in the open literature, Fusaria are produced in the Soviet Union at the Berdsk Chemical Works, which is under the Main Administration of the Microbiological Industry and is located near the "Science City" of Novosibirsk in Siberia. Such a facility also has been a suspect biological warfare (BW) agent production and storage facility. The only difference between an antibiotic and mycotoxin is their target specificity. Both are produced by fungi, but the mycotoxins are relatively more toxic to man than to microorganisms. Mycotoxins can be produced in good yield employing the same techniques that are used to produce some antibiotics. Thus, it may be concluded that the Soviets could produce trichothecenes in large amounts. They produce an antibiotic that is a trichothecene derivative, which would provide an ideal cover for agent production facilities.

Medical Effects of the Trichothecenes in Humans

The most prominent symptoms associated with trichothecene poisoning are listed in table D-5. Striking among these is the rapid onset of vomiting with severe itching and tingling of the skin. Hemorrhage of the mucous membranes and bloody diarrhea follow. That table also presents symptoms reported to have been caused by the trichothecenes in gas attack victims in Laos, Kampuchea, and Afghanistan. The correlation is striking.

LD_{50} values (dose required to produce death in 50 percent of a test population) of the trichothecenes in laboratory animals range from 0.1 mg/kg to greater than 1,000 mg/kg depending on the particular toxin, species, and route of exposure. The LD_{50} of T-2 toxin in cat is 0.5 mg/kg. However, the ED_{50} (dose required to produce a desired physiological effect in 50 percent of a test population) is much lower. The ED_{50} to produce a vomiting reaction is 0.1 mg/kg, and for skin irritation it is in the tenths of microgram range.

Most of the data concerning the toxicological effects of the trichothecenes are derived from animal data in which pure compounds were administered by oral, subcutaneous, intraperitoneal or intravenous routes. Unfortunately, there are no reports concerning the effects of inhalation of mixtures of the compounds. Therefore, it is difficult to speculate concerning the effects that would be expected in humans who were exposed to an aerosol of mixtures of these very potent toxins. The most useful data concerning exposure in humans was obtained in a Phase I clinical evaluation of anguidine (diacetoxyscirpenol) as an anticancer drug. Diacetoxyscirpenol was administered by intravenous infusion. Doses of 3 mg/m^2/day caused immediate onset of nausea, vomiting, diarrhea, somnolence (and/or mental confusion), fever, chills, a generalized erythema with a burning sensation, hypotension, dyspnea, stomatitis, hives, and ataxia. Because of the side effects the treatment was discontinued. The properties which make the use of diacetoxyscirpenol potentially useful as an anticancer drug are the same as those responsible (in part) for its extreme toxicity. It and the other trichothecenes cause extensive damage to rapidly dividing cells such as tumor cells. Unfortunately, the cells of the lining of the gastrointestinal tract and bone marrow are also rapidly dividing and the effects of the trichothecenes on these cells result in severe rapid degeneration of these tissues. The compounds also have direct effects on the clotting factors in the blood (that is, a primary effect on Factor VII activity and a secondary effect on prothrombin) which result in excessive hemorrhage following trauma.

The other useful body of clinical data concerning the effects of trichothecenes in humans is drawn from descriptions of the course of the disease in the natural outbreaks that occurred in the Soviet Union. The clinical picture may be divided into four stages. The effects produced are very similar to radiation poisoning and there is a latent phase in which the overt symptoms disappear, as occurs in radiation poisoning.

The first stage occurs within minutes to hours after ingestion of toxic grains. The symptomatology described was produced by oral exposure to low doses. In exposure by inhalation, the symptoms may be more pronounced or the time course accelerated. The characteristics of the first stage include primary changes, with local symptoms, in the buccal cavity and gastrointestinal tract. Shortly after ingestion of toxic grain, the patient experiences a burning sensation in the mouth, tongue, throat, palate, esophagus, and stomach as a result of the toxin's effect on the mucous membranes. The tongue may feel swollen and stiff and the mucosa of the oral cavity may be hyperemic. Inflammation of the gastric and intestinal mucosa occurs, along with vomiting, diarrhea, and abdominal pain. In most cases excessive salivation, headache, dizziness, weakness, fatigue, and tachycardia accompany the initial stage. There may be fever and sweating, but the body temperature normally does not rise. The leukocyte count may begin to decrease in this stage and there may be an increased erythrocyte sedimentation rate. This first stage may last from three to nine days.

The second stage is often called the latent stage or incubation period because the patient does not feel ill and is capable of normal activity. It is also called the leukopenic stage because its main features are disturbances in the bone marrow and the hematopoietic system, characterized by a progressive leukopenia, a granulopenia, and a relative lymphocytosis. In addition, anemia and decreases in erythrocytes, in the platelet count, and hemoglobin occur. Disturbances in the CNS and autonomic nervous systems may occur. Weakness, vertigo, fatigue, headache, palpitations, and mild asthmatic conditions may occur. Visable hemorrhagic spots (petechiae) begin to appear on the skin and this marks the transition to the third phase. The second stage may last three to four weeks. The transition to the third stage is sudden and symptoms progress rapidly.

In the third stage petechial hemorrhages occur on the skin of the trunk, arms, thighs, and face and head. They can vary from a millimeter to a few centimeters in size. Capillaries are very fragile and any slight trauma results in hemorrhage. Hemorrhages of the mucous membranes of the mouth, tongue, soft palate, and tonsils occur. Nasal, gastric, and intestinal hemorrhages can be very severe. Areas of necrosis begin to appear on the lips, fingers, nose, jaws, eyes, and in the mouth. Lymph nodes are frequently enlarged and the adjoining connective tissue can become so edematous that the patient has difficulty opening his mouth. Blood abnormalities previously described are intensified. Death may occur from hemorrhage, strangulation (due to swelling) or secondary infection.

The fourth stage is convalescence. Three to four weeks of treatment are required for disappearance of necrotic lesions and hemorrhagic effects. Two months or more may elapse before the blood-forming capability of the bone marrow returns to normal.

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ANNEX E [1]

MEDICAL EVIDENCE

Southeast Asia

Since 1976, multiple sources—refugees, relief medical and civilian workers, and many specially qualified physicians—consistently have detailed unusual signs and symptoms of victims of "yellow rain." Specifically, victims in Southeast Asia subjected to a direct attack of the yellow powder, mist, smoke, or dust would be seen to begin retching and vomiting in a matter of minutes. This and the effects described below were not pronounced in individuals even 100 meters from the attack zone, indicating a relatively dense chemical/carrier combination that was effective in low wind conditions.

Unlike that caused by a traditional riot-control nausea agent, the initial induced vomiting following exposure to "yellow rain" was protracted over hours to days and was often accompanied by dizziness, with rapid heartbeat and apparently low blood pressure, chest pain, loss of far-field vision, and a feeling of intense heat and burning on the skin, but not described as being most acute in the groin and axillae. Thus, the acute signs and symptoms match some of the effects of traditional vomiting and urticant agents, but clearly not all.

A significant number of victims also reported intense "red eyes," "bleeding gums," convulsions or more often trembling, and vomiting of blood with or without production of copious amounts of saliva within the first hours after the attack. Again, this could last many hours to days, apparently depending on the exposure level. Thick mucus, pinpoint pupils, respiratory collapse, prolonged spasticity, and involuntary urination or defecation were seldom reported after a "classic" attack of "yellow rain," and this absence helped to rule out organophosphate nerve agents in the minds of CW experts. Many medical and environmental samples also ruled out these and other traditional agents such as DM, DS, and others.

[1] This annex is unclassified

Many observers of the "yellow rain" effects reported formation within several hours of small (1 centimeter), homogeneous, hard, fluid-filled blisters over only exposed areas of skin, frequently including the victim's hands, arms, entire throat, and face—whenever skin was uncovered. In most cases, the vomit, after two to eight hours, contained blood, and in many cases a good deal of it. About half of those receiving the most concentrated doses of yellow material, who had been directly under the spray, were observed several hours after the attack to cease vomiting temporarily. This interval was often followed in five to 15 minutes by a period of great pain when the victim would hold his abdomen and emit a "gush" of blood from his mouth and nose. These individuals were usually dead within minutes after that. Close questioning by physicians of those who witnessed these final moments leave no doubt that these observed effects were the results of severe gastrointestinal bleeding, significant pulmonary bleeding, temporary compression of accumulated blood in the stomach, and finally projectile vomiting of as much as several hundred milliliters of blood. These findings were consistent with animal and human autopsies.

Very recent, as yet unpublished data on effects of these compounds in animals show striking and sudden impairment of several elements of the normal blood clotting mechanisms. Observers and victims have reported signs and symptoms occurring within a few minutes to a few hours after exposure. These signs and symptoms, including bleeding, the other systemic effects mentioned above, and in some cases death even from skin absorption, are consistent with these emerging laboratory data.

Many victims of the yellow material received less than the full brunt of a spray, or entered the attack zone several hours to two days later, or consumed food or water contaminated by the material. These individuals often within the next 24 hours developed signs and symptoms similar to those of the more directly affected (but often without pronounced skin effects if they did not contact the powder residue directly). In addition to attacks of intense vomiting (five or six times a day), they also had diarrhea, with bloody stools passed up to eight times a day. Bleeding under the fingernails and around the skin of the eyes and severe bruising of the skin are also commonly reported. Opiates helped the fluid loss in adults; but, in children or young persons not able to tolerate the treatments of raw opium and water, death occurred in about half the cases after 10 days to two weeks. On the basis of reported signs and symptoms, the cause of delayed death was almost certainly dehydration.

In many cases chemical attacks are reported to produce symptoms other than the ones described here. There has always been, however, a direct association of the symptoms above with reports of "yellow rain" attacks—that is, when yellow material is used these symptoms appear; other agents may give rise to other symptoms. Although it is possible to have one or even several of these symptoms associated with traditional CW agents, no expert has been able to "fit" the sequence, severity, and consistency with any of them. In many cases victims and observers were examined, histories taken, and interviews conducted by several health professionals weeks apart. Remarkable consistency has been observed.

From the beginning of the "yellow rain" episodes in 1976, autopsies have occasionally been reported anecdotally. Some have been done by less than expert technique, some by nonphysicians, and some were on animals rather than human victims. However, the consistency of the early reported "putrefaction" or "rottenness" of the digestive tract within 12 to 48 hours after death led many forensic experts to suspect that one effect of the poison, whatever it was, was to cause necrosis (cell death) of rapidly dividing mucosa (mucous membranes), especially in the stomach and upper small intestine. Other autopsy findings included hyperemia (engorgement with blood) of digestive mucosal linings, and remarkably intense congestion and swelling in the lungs, liver, spleen, and sometimes the kidneys. These and other findings often led experts in toxicology and pathology to suggest mycotoxin or even trichothecene intoxication based on clinical and pathological data alone.

Although not a common cause of death, trichothecene effects have been reported in the forensic, oncological, and toxicological literature for several years. Unpublished findings often were discussed in symposiums. In several dozens of cases, toxic effects in humans and animals have been carefully recorded, and they match those of the "yellow rain" story with good precision. (See table E-1.) There are no additional signs effects of known trichothecene intoxication not frequently reported by victims, nor are there any reported "yellow rain" symptoms that cannot be explained by the effect of the four specific trichothecene toxins found in the samples, and the doses inferred from the operational situation and description.

From a medical viewpoint, there are no significant differences in the reporting from Laos and Kampuchea. The timing and delivery systems have sometimes varied, but the effects of the chemical agent, both clinically and pathologically, are identical. In one case, a series of blood samples from Kampuchean victims also showed a trend toward leukopenia (reduction in number of white blood cells) and the presence of a trichothecene metabolite (HT-2) consistent with trichothecene intoxication (see annex D for blood analysis results). To a first order, dose-response effects are also seen, and routes of administration are consistent with effects.

Public Health Issues. An early hypothesis (1978-79) was that a significant number of the deaths, especially in Laos, could be explained by the heavy use of riot-control agents such as CS, CN, DM, and agents which cause itching and/or blistering. The hypothesis was rejected quickly on two grounds. First, trace contaminant analysis did not show the presence of any of these compounds in samples (several samples did, however, contain a trichothecene precursor). Secondly, contrary to commonly held views, the epidemiology of diseases endemic to the Central Highlands and the public health of the H'Mong do not support the view of malnourished, disease-ridden, and weak persons who would succumb easily to riot-control agents. Also, a number of studies have shown the opposite: a relatively low incidence of pulmonary disease (lower than what could otherwise account for certain effects); better nutritional states than could otherwise account for death in 10 days to two weeks from water loss (dehydration) and caloric depletion; and a death rate of near zero from causes other than infection, gerontological causes, and trauma.

Table E-I

Comparison of Reported "Yellow Rain" Effects With Known Trichothecene Effects

"Yellow Rain" Reports[a]	Effects of Trichothecenes
1. Nausea, vomiting—severe, immediate	1. Nausea, vomiting—severe, immediate
2. "Falling down, world turning"	2. Dizziness
3. "Burning of skin" . . . small blisters	3. Generalized erythema with a burning sensation of skin
4. "Shaking all over, flopping like fish out of water"	4. Ataxia (failure of muscular coordination), occasional tremors and convulsions
5. "Bleeding eyes"	5. Congestion of the sclera (white outer coat of eyeball) and blood in tears
6. "Pounding" chest, rapid heartbeat, weakness	6. Hypotension (abnormally low blood pressure) with secondary rise in heart rate
7. Severe pain in center of chest	7. Angina (substernal chest pain)
8. Sleepiness, "not able to talk"	8. Somnolence, central nervous system symptoms
9. Bleeding gums and profuse saliva	9. Stomatitis (inflammation of oral mucous membranes) and ptyalism (excessive salivation)
10. "Can't breathe"	10. Shortness of breath
11. "Skin and body hot with cold"	11. Fever and chills
12. Diarrhea with blood	12. Diarrhea with blood
13. Loss of appetite, inability to eat	13. Anorexia
14. Bleeding into skin and fingernails	14. Thrombocytopenia (decrease in number of platelets—white blood cells involved in clotting of blood) and purpura (skin discoloration caused by hemorrhage into tissues)
15. Drop in white blood cell count	15. Leukopenia and anemia
16. "Rotten esophagus, stomach, intestines; soft spleen and liver"	16. Rapid necrosis of linings of gastrointestinal tract; lymphoid necrosis in spleen and liver
17. Swelling of all organs	17. Congestion of all organs

[a] Effects are immediate at levels near to or above a rough estimate of 500 to 1,000 mg total body burden for an adult. Although inhalation data are pending, the levels are consistent with reported lethal and sublethal doses. Trichothecenes in combination, when directly ingested or inhaled, or in purified form, are more toxic in lower concentrations and the order of signs and symptoms and timing varies.

Afghanistan

Some deaths with bleeding have been described in the accounts from Afghanistan. In one series of cases a physician examined a number of persons who had been exposed to sublethal doses of a yellow smoke/black smoke combination attack and one man near death after a series of attacks. Hemoptysis (nasal bleeding)—but not hematemesis (bleeding from the gastrointestinal tract)—was reported in about half of these and other cases.

Several features of at least one of the chemical agents—an incapacitant—used in Afghanistan defy explanation at this time. No good candidate has yet been identified which will selectively inhibit the central nervous system to cause unconciousness for several hours as reported. A second finding has been the presence of a dermal anaesthesia, affecting only exposed areas of skin.

Postattack Medical Survey. There is evidence that after some of the attacks in Laos and Afghanistan, Soviet or Communist (Pathet Lao) forces entered the attack zones to conduct surveys. Several reports indicate that a group of survivors from a toxin attack on a Laotian village were taken several kilometers from the village and injected with a small volume of a clear solution said by their captors to be a "new" medicine to "assess the gas." The injections were given intramuscularly in the upper arm and reportedly did nothing to alleviate the weakness, nausea, vomiting, or diarrhea suffered by the survivors. One source reported the effect of the drug was to cause an immediate sensation of warmth throughout his body. Only the use of opium later eased the discomfort, after the survivors had lied to their captors about how much better the new medicine made them feel. It is probable that the procedure was a test, either of a new antidote or of a drug developed to reduce incapacitation from the nausea and vomiting.

Similarly, in a few cases in Afghanistan, Soviet troops were reported to disembark from helicopters or armored personnel carriers at the edge of an attack site. Three or four, dressed in full anticontamination gear, walked among the dead; examined the corpses; and, opening them with a crude autopsy incision, examined the organs in the abdominal and thoracic cavities. In one report a solution was poured into the incision. When the corpses were later recovered by Mujahedin guerrillas, the body cavity contents were destroyed beyond recognition. These bizarre stories would be discounted were it not for the past reliability and quality of reporting from the sources, which is believed excellent.

These and a small number of additional reports support the hypothesis that the perpetrators of some of the attacks are interested in studying aftereffects, lethality, or some other quasi-experimental aspect of use of a new chemical weapon. Details are not sufficiently clear to explain the purpose of the above events, and "destruction of evidence" is by itself not an entirely credible explanation. Recent indications from Afghanistan indicate that one purpose of these reviews of bodies and the field surveys is to determine levels of toxic materials still present in the attack zone before Soviet troops occupy it.

ANNEX F

REPORT OF THE WEAPON AND SPACE SYSTEMS INTELLIGENCE COMMITTEE, APRIL 1980, ON USE OF CHEMICAL WARFARE IN AFGHANISTAN, LAOS, AND KAMPUCHEA

The Weapon and Space Systems Intelligence Committee has reviewed all available intelligence as of 25 March 1980 to determine if chemical agents have been used in Afghanistan, Laos, and Kampuchea.

Afghanistan

1. There is an even chance that lethal chemicals such as nerve agents have been used by the Soviets in Afghanistan but we lack confirmatory evidence.

2. We are almost certain that irritant agents have been used by the Soviets against the Afghan insurgents.

3. The presence of Soviet chemical defense forces in Afghanistan provides the capability to engage in chemical warfare. We cannot predict whether the Soviets will exercise this capability.

The earliest reported use of chemical weapons occurred during the summer of 1979, when refugees claimed that "toxic gas bombs" were used in Bamian Province. In the fall of 1979 reported on the presence of "chemical" bombs at several airfields and their use against insurgents. The bulk of reporting since then has come from Afghan refugees, who have described aircraft attacks with gas bombs and canisters, causing dizziness, sickness, breathing difficulty, and in some cases death.

confirmed the deployment of a chemical defense battalion (which is standard issue to Soviet forces) at Qonduz and Shindand, and chemical defense equipment has been observed in the Kabul area. The unit at Qonduz has set up two small nonstandard personnel and clothing decontamination stations.

The evidence for the Soviet possession of irritant agents is convincing. There is no conclusive evidence of Soviet use of lethal agents. We believe that any chemicals used or stored in Afghanistan would be supplied by the Soviets. We would require samples of munitions or fragments, contaminated materiel, and/or the debriefings of victims by qualified medical experts to establish not only that lethal agents were used but also the exact type of agent employed.

Laos

1. We are almost certain that the Vietnamese (PAVN) and Laotian People's Democratic Army forces have used lethal chemical agents against the dissident H'Mong (Meo) tribesmen over a period of more than three years. The most recent report is from October 1979.

2. From the reported symptoms, at least three types of chemical agents have been used: a nerve agent; an unidentified lethal chemical or combination of chemicals; and an irritant agent of unknown type.

3. There is good evidence that the Soviets have supplied chemical munitions and advice to PAVN forces and the Laotians.

4. Stores of chemical munitions probably are located near Xiangkhoang and Vieng Sai (Military Region II), Savannakhet (Military Region III), and Pakxe (Military Region IV).

Refugee and clandestine reporting has described repeated chemical attacks on combatants and the civilian population with rockets, bombs, sprays, and artillery weapons. Eyewitnesses have been interviewed by US medical experts. However, chemical analysis of roofing material supposedly contaminated with a lethal chemical agent proved negative. [redacted] provide good evidence that the Soviets have supplied unidentified chemical agents and munitions to Laos and have provided assistance in usage and storage.

Kampuchea

1. There is insufficient evidence to support allegations that PAVN forces or those of the People's Republic of Kampuchea (PRK) have used lethal chemicals against Democratic Kampuchean (DK) guerrillas.

2. Vietnamese and PRK forces probably are using irritant agents against both the DK and Khmer Serei forces, especially along the Thai-Kampuchean border.

The possibility of a DK propaganda campaign is real. Of 76 CW attacks in Kampuchea reported between October 1978 and March 1980, 62 originated in DK propaganda broadcasts and press releases. Because the DK forces, unlike the H'Mong or the Afghan dissidents, remain under central control, the planting of other stories is possible. Five reports from DK informants were surfaced through the International Red Cross and Thai military. The remaining reports were provided by Thai intelligence, Khmer Serei forces, and PAVN defectors. [redacted]

The Vietnamese have the means of delivering chemical munitions, but have no capability to produce the agents themselves. Lethal chemical agents would have to be supplied by the USSR; irritant agents would be either Soviet supplied or drawn from captured US supplies.

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