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YELLOW RAIN: THE STORY COLLAPSES

by Julian Robinson, Jeanne Guillemin, and Matthew Meselson

In September 1981 the Reagan administration charged that Soviet-backed forces in Southeast Asia were waging toxin warfare. The Soviets flatly denied the charge, but the administration continued to make the accusation and, in 1984, incorporated it into the president's first *Report to the Congress on Soviet Non-Compliance with Arms Control Agreements*. Subsequent noncompliance reports reiterated the charge, claiming that the use of toxins continued at least into 1983. Most recently, in the 1987 report, the administration repeated its conclusion that "the Soviet Union has been involved in the production, transfer, and use of trichothecene mycotoxins . . . in violation of its legal obligation under international law as codified in the Geneva Protocol of 1925 and the Biological and Toxin Weapons Convention of 1972."[1] According to the administration, the attacks generally were conducted by aircraft spraying a yellow material that fell like rain and that contained trichothecene toxins, causing illness and death to thousands of victims. In presenting its case, the administration relied heavily on three kinds of evidence. First, there were interviews with alleged victims and eyewitnesses—most of them Hmong tribespeople from Laos living in Thai refugee camps, others Khmer Rouge soldiers near the Thai-Cambodian border. Second, there were actual samples of the suspected CBW

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[1] *Most of today's arms control in the field of chemical and biological warfare (CBW) rests on these two treaties. The Protocol outlaws use of CBW weapons while the Convention outlaws possession of germ and toxin weapons, treating all naturally occurring poisons as toxins. Trichothecenes of the type referred to by the president fall within the scope of both the Convention and the Protocol because they are mycotoxins, poisonous substances generated by certain molds or fungi.*

agent handed in by alleged witnesses. Finally, there were chemical analyses reporting the presence of the trichothecene toxins in samples from alleged attacks.

The administration's scenario and its supporting evidence were presented authoritatively in two special reports to Congress from the State Department. The March 1982 report of then Secretary of State Alexander Haig, Jr., stated that "beginning in the fall of 1978, the majority of the attacks were carried out by aircraft spraying a yellowish substance which 'fell like rain.' " And again, in the November 1982 report of Secretary of State George Shultz: "Descriptions of the 1982 attacks have not changed significantly from descriptions of earlier attacks. Usually the Hmong state that aircraft or helicopters spray a yellow rain-like material on their villages and crops." The Shultz report also stated, "We now know that the yellow rain contains trichothecene toxins and other substances that cause victims to experience vomiting, bleeding, blistering, severe skin lesions and other lingering signs and symptoms."

The Haig and Shultz reports were presented with obvious political authority and appeared to be based on conclusive evidence. Nevertheless, in various parts of the U.S. government, investigation of the chemical warfare allegations did not stop. To the contrary, the laboratory and field studies became more systematic, replacing the more improvised procedures that had been relied on initially. As investigations broadened both within the government and outside and in other countries, key elements of the evidence upon which the administration's case rested could not be confirmed. In addition, scientists made an unexpected discovery that was altogether at odds with the administration's scenario. As traced in what follows, in part through documents only recently declassified and so far unreported, these developments effectively destroyed the case for treaty violation presented by the administration. Nevertheless, the allegation itself is still made at the highest level of government.

In September 1978 the U.S. embassy in Bangkok, Thailand, sent its first telegram to Washington reporting interviews conducted by its personnel with Hmong refugees who claimed to have witnessed chemical and biological warfare in Laos. The telegram said that refugees claimed to have

been attacked by aircraft with rockets, bombs, stones, and "medicine from the sky." As refugee claims of chemical warfare continued to come in, the State Department dispatched a Foreign Service officer to Thailand to conduct more interviews. He and another officer went to the Thai camps where they interviewed, through interpreters, 22 Hmong refugees in June 1979. Nineteen of the refugees told of a CBW agent that was yellow. Two of them handed in samples, leaves on which there were yellow spots a few millimeters in diameter. The following October, four U.S. Army medical and toxicological specialists went to refugee camps in Thailand where they completed 38 more interviews with Hmong who claimed they had witnessed attacks. The army interviewers also were given a sample—small yellow spots on pieces of bark from a village rooftop.

By early 1983, Hmong refugees claiming to have witnessed attacks had turned in dozens of samples of the alleged CBW agent to American, Australian, British, Canadian, French, Thai, and other investigators. These samples displayed a striking uniformity. Virtually all of them were yellow spots or powdery yellow scrapings. In what probably was the first published use of the expression, an English-speaking Hmong soldier was quoted by the writer Stanley Karnow in the August 13, 1979, issue of the *Baltimore Sun* as describing an allegedly poisonous spray delivered by jet aircraft in Laos as "yellow rain."

When tested for standard chemical warfare agents the samples yielded negative results. But in the interviews, investigators thought they discerned a constellation of symptoms—skin irritation, dizziness, nausea, and bloody vomiting and diarrhea—that eventually pointed them in the direction of toxins, including the trichothecenes. In July 1981 a leaf and stem sample from the area of a supposed attack in Cambodia near the Thai border was sent to a University of Minnesota laboratory for testing for trichothecenes. The report came back positive. Soon after this, during a September 13 speech in West Berlin, Haig announced that the United States now had "physical evidence" of toxin warfare in Southeast Asia. This physical evidence, Haig said, had "been analyzed and found to contain abnormally high levels of three potent mycotoxins—poisonous substances not indigenous to the region and which are highly toxic to man and animals."

Subsequently, the Minnesota laboratory would report trichothecenes in four more environmental samples from Southeast Asia and in samples of blood, urine, or tissue from about 20 Hmong refugees and Khmer Rouge soldiers and civilians, collected between March 1981 and March 1983. A laboratory at Rutgers University in New Jersey reported trichothecenes in a sample of yellow powder from Laos. And a gas mask from Afghanistan was reported to have traces of trichothecenes on its surface. A substantial body of evidence was thus accumulating. Further, government officials claimed that they had secret intelligence data that confirmed the specific dates of CBW attacks reported by refugees. Congress seemed to be persuaded. Impatient with those who still questioned the administration's charges, an editorial in the February 15, 1984, issue of the *Wall Street Journal* contended flatly, "Among men of affairs the 'yellow rain' debate is closed."

A Hitch in the Scenario

But already in 1982 an unexpected discovery began to move the investigation of yellow rain into an altogether new direction. The administration never claimed that more than four samples of the yellow material contained trichothecenes. Even in these the toxins reportedly made up less than a few hundredths of a per cent of the sample. What was the remaining 99.9 per cent? From 1979 until the beginning of 1982, U.S. government laboratories had performed various tests on the growing collection of yellow spots and powders without discovering their principal component. Then, in January 1982, a British government scientist at the Chemical Defence Establishment at Porton Down put a sample of yellow rain under an ordinary microscope and discovered that it consisted almost entirely of pollen. Soon afterward, the same discovery was made independently by scientists in Thailand and Canada. The British finding was passed on to the United States and was confirmed with many additional samples by scientists at the Army Chemical Systems Laboratory in Aberdeen, Maryland. It also was confirmed at defense establishments in Australia, France, and Sweden. Altogether, more than 50 samples of yellow spots and powders from alleged attacks in Laos and Cambodia were exam-

ined under the microscope, and every one of them consisted mainly of pollen.

The possibility that the pollen was merely a coincidental contaminant of the samples could be rejected quickly. The concentration of pollen hardly varied from one sample of yellow rain to another and was thousands of times too high to have resulted from the general presence of pollen in the environment. The finding that the yellow rain was mainly pollen created great difficulties for the U.S. scenario. The administration's response was to argue that the Soviets deliberately added pollen in manufacturing yellow rain. At a November 1982 press conference to release the Shultz report, the senior State Department intelligence officer investigating yellow rain, Gary Crocker, said, "It contains pollen, and not windborne pollen, but pollen that would be commercially collected or is collected, if you will, by insects, the type of thing . . . a honeybee would take from flowers." An Army medical intelligence analyst who was present, Sharon Watson, described the presumed combination of pollen and toxins as a "very clever mixture," explaining that after the drops of yellow rain became dry, wind could disperse the material as toxic dust that could be inhaled. But this theory could be dismissed for a number of reasons, not the least of which was that the samples of yellow rain had no such tendency to disperse.

Nevertheless, in a December 1982 address to the First Committee of the U.N. General Assembly, Kenneth Adelman, then U.S. deputy representative to the United Nations, announced: "We are now, however, able to isolate the components of yellow rain. . . . There is good evidence for the presence of commercially-prepared pollen as a carrier and to help ensure the retention of toxins in the human body." A year later a U.S. official, quoted in the January 9, 1984, issue of *Chemical & Engineering News*, referred in a background briefing to "an association of bee-pollen collecting facilities near the confines of a chemical weapons facility in the Soviet Union." When asked why there should be pollen in every sample of yellow rain, Deputy Assistant Secretary of State for Politico-Military Affairs John Hawes replied: "I have no idea how the Soviets produce this stuff. We've

not been in their factory."[2] The notion that the Soviets collected pollen from honeybees and added toxins to make yellow rain taxed the imaginations of many, both in and out of government. But if the pollen was not part of a CBW agent, what was its origin? The answer, at first put foward only tentatively, was that yellow rain was not a CBW agent at all, but a phenomenon of nature: the feces of wild honeybees. This suggestion was made by Thomas Seeley, a Yale University honeybee expert, and first presented at a meeting of the American Association for the Advancement of Science in May 1983.[3] It was greeted with derision by administration officials, yet it provided for the first time an alternative to the administration's theory that yellow rain was a weapon, an alternative that could be subjected to simple and reliable scientific tests.

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The spots of yellow rain and of honeybee feces proved indistinguishable in size, color, and general appearance. And, like bee feces, the yellow-rain samples were composed almost entirely of pollen. Moreover, the pollen grains in yellow-rain samples were merely empty husks, like those digested by honeybees. The match extended to the fine level of detail revealed by the electron microscope. Analyses done at the Smithsonian Institution in Washington and in other laboratories specializing in pollen identification in France, Great Britain, and the United States showed that the pollen in yellow-rain samples was from plants indigenous to Southeast Asia and was composed of precisely the kind of pollen gathered and eaten by wild honeybees in the region's forests. In short, no sample of the yellow material from alleged attacks in Laos and Cambodia was found to be

[2] *Quoted in Robert Bazell, "Bees Did It,"* New Republic, *2 February 1987, 10.*

[3] *P. S. Ashton et al., "Comparison of Yellow Rain and Bee Excrement" (Paper presented at the annual meeting of the American Association for the Advancement of Science, Detroit, Mich., 31 May 1983).*

anything other than honeybee feces. This included even the yellow-rain samples reported positive for trichothecenes.

At the time, many aspects of tropical Asian honeybee behavior had not been closely studied. In particular, entomologists did not know whether these bees defecated collectively, producing showers that could be mistaken for sprays from aircraft. But in Thailand in March 1984, two American university scientists and a Thai colleague discovered that wild honeybees, flying too high to be noticed, do indeed conduct collective cleansing flights, lasting several minutes and covering areas of an acre or more with hundreds of thousands of yellow spots.[4] Although one might think that people living in the Southeast Asian countryside would recognize bee feces for what they are, Hmong refugees and Thai villagers shown spots of bee feces on leaves usually did not recognize them. Indeed, some of the Hmong identified the spots as "kemi," a term they have come to use for chemical weapons.

The mistaken identification of bee feces as poison from the sky was not limited to the Hmong, although the administration was not familiar with this fact. In 1976 in China, strange, sporadic showers of yellowish material were noticed in different parts of Jiangsu province. The local people, who actually called the showers "yellow rain," associated them with serious threats to their well-being. Some saw the yellow showers as "air-dropped poison" and would not consume water or food that might have been exposed to it. University scientists examined local inhabitants and scrutinized local medical records for any abnormal incidence of clinical disease, which they did not find. They subjected samples of the yellow substance to chemical analysis, which revealed nothing out of the ordinary. But under the microscope they saw pollen, and this led them, by the same route previously described, to conclude that the yellow material was bee feces.[5] The discovery

[4] *Such incidents were witnessed by Thomas D. Seeley, Matthew Meselson, and Pongthep Akratankal. Thomas D. Seeley et al., "Yellow Rain,"* Scientific American *253, no. 3 (September 1985): 128–137.*

[5] *Zhang Zhongying et al., "A Study of the Origin and the Pollen Analysis of 'Yellow Rains' in Northeast Jiangsu" (in Chinese),* Kexue Tongbao *22, no. 1 (1977): 409–412; and Zhang Zhongying, "Yellow Rain" (in Chinese),* Ziran Zazhi *9, no. 2 (February 1986): 122–125.*

that the yellow rain in Southeast Asia was honeybee feces directly contradicted the administration's allegations of chemical warfare. If the yellow rain was just bee feces, the administration's identification of the supposed toxic material was invalidated. Nor could the two other main categories of supporting evidence—interviews and trichothecene analyses—remain unaffected. The discovery that yellow rain is bee feces meant that the testimony of many who claimed to be eyewitnesses was greatly compromised. How could they have seen CBW attacks intense enough to kill and injure scores of people without noticing any material substances but honeybee feces? Certainly bee feces could not cause such effects. Yet it was the testimony of Hmong refugees that had directed attention to the yellow materials in the first place—the same testimony from which the symptomatology and much of the circumstantial evidence described in the Haig and Shultz reports had been drawn. Did this mean that these parts of the Washington scenario were now only precariously supported, or was the refugee testimony still to be regarded as a bulwark of the administration's case? Likewise, was it possible that the toxin reports were in error or that, if trichothecenes were indeed present in some of the samples, their origin was natural, not artificial?

The Pressure Mounts

To students of CBW, the trichothecenes were another bizarre aspect of the Washington scenario. Naturally occurring poisons of other types—bacterial and algal toxins, for example, but not fungal toxins—are known to have been developed for weapons purposes, not least by the United States prior to President Richard Nixon's renunciation of toxin weapons in 1970. But from what was reported in the scant literature on trichothecenes, they seemed improbable CBW agents. Their aggressive characteristics, such as their ease of distribution and their lethality, appeared inferior to those of more familiar military poisons, making it difficult to imagine military situations in which they would be preferred. Nonetheless, their very implausibility as CBW agents seemed to suggest that the Reagan administration must have had strong evidence for charging that they were being used. This, it is now known, was not so. The early reports of trichothecenes in the samples were totally unverified, and the corroboration that emerged later was tenuous and unreliable.

At the time of Haig's speech announcing the trichothecene finding to the world, the evidence consisted of no more than a single uncorroborated analysis of a leaf and stem sample from Cambodia. The source of the crucial sample was ambiguous. In March 1981 a Thai army chemical officer had given a sample of vegetation to an American embassy official. Reportedly, it came from an area in Cambodia where Khmer Rouge soldiers had fallen ill after drinking the water and also after passing through a region with a strange, perfume-like smell. Khmer Rouge officials could not explain how a poison might have been disseminated: They had seen no aircraft spraying nor any artillery with chemical rounds firing. The State Department's regional medical officer, Dr. Henry Wilde, went into Cambodia and examined patients allegedly affected by these incidents. He concluded in a March 1981 report that their illness could be ascribed to "chronic malaria and/or other natural diseases as well as possible battle fatigue."

The vegetation sample was sent to the Army Chemical Systems Laboratory, where it was divided into several portions. One of these, a leaf and stem sample, was provided to Watson at the U.S. Army Medical Intelligence and Information Agency (USAMIIA) in Fort Detrick, Maryland, with a notation that "mold and other biological growth" had been observed on it. Then, in July 1981, this portion was sent by means of an intermediary contractor to the Minnesota laboratory. On August 17, in a then secret message to the rest of the U.S. intelligence community, Watson announced the positive report of trichothecenes.

While interagency discussion of the need for corroborating the finding proceeded, pressure mounted to present this new and potentially dramatic information to the public. On August 31, Watson received a telephone call from the office of Richard Burt, then director of the State Department's Bureau of Politico-Military Affairs, asking that the August 17 message be prepared for public release. She and others at the USAMIIA thought the request "ill-advised" because of the lack of corroborative tests. But as her now declassified August 31 memorandum on the telephone

call noted, "Despite these concerns, it was decided to release the information since we were told that it would break anyway with or without our permission."

The same day, Burt sent a memorandum to Haig summarizing the toxin finding and urging that "we need to be prepared to move quickly to ensure that the administration is recognized as being on top of this important turn in events." But apparently the State Department's objective went well beyond projecting an informed public image. In a September 3 briefing memorandum, Burt cautioned Haig to withhold the trichothecene report from the press for the time being, "in order not to preempt our strategy for securing the maximum impact from this issue." On September 11, Haig sent President Ronald Reagan a memorandum telling him about the trichothecene report and informing him that "in order to ensure that the administration is recognized as being on top of this important development, I plan to present this new information publicly at the earliest opportunity, which will be my September 13 speech in Berlin."

Following the speech, U.S. government scientists sought to replicate the finding. The task ahead was no easy one. To analyze small samples of a natural substance for quantities of other organic chemicals is extremely difficult. Samples of the kinds being sent in from Southeast Asia presented major risks of getting analytic results either falsely positive or falsely negative for trichothecenes. In October 1981 the army approved the plans of its Chemical Systems Laboratory to develop an adequate analytic capability of its own for trichothecenes. Abroad, in Britain, Canada, France, and Sweden, the West Berlin speech had stimulated government agencies to do likewise.

Not until October 1982 did the Chemical Systems Laboratory satisfy itself that it had developed a method of the requisite reliability. The army then began a series of new analyses, examining more than 80 samples from alleged attacks in Southeast Asia. In one of these, a pollen-rich yellow powder from Laos known as C-168-81, relatively large amounts of trichothecenes had been reported from the Minnesota laboratory 1 year previously. The Chemical Systems Laboratory found no trichothecenes in this or in any of the other samples it examined from Laos and Cambodia.

Simultaneously, the government laboratories abroad were coming on strong. They all used analytic methods that basically were the same as the one the army had chosen, less stringent versions of which had been used in the Minnesota and New Jersey laboratories: an elaborate and powerful technique combining gas chromatography and mass spectrometry known as GC/MS. No other methods were likely to be reliable; even GC/MS, without rigorous precautions, could easily yield false positives.

At no time was any case documented in which diagnostic examination or autopsy provided clear evidence of exposure to chemical warfare agents.

The largest of these overseas activities was at Porton Down. Starting in March 1982, Porton analyzed about 50 environmental samples and about 20 samples of blood and urine for trichothecenes. These samples were furnished by a British collection effort in Thailand and from allies, and included a portion of the C-168-81 sample provided by the U.S. Army. On June 7 of that year the British government stated, in a reply to a parliamentary question in the House of Lords, that it had been led to "believe that chemical weapons, probably including mycotoxins," had been used in Southeast Asia. But 4 years passed without any release of Porton's analytic findings, and it came to be asserted, both in internal documents of the U.S. government and in the press, that Britain was deliberately withholding confirmatory data to avoid disrupting British-Soviet relations.

Finally, in May 1986 the British government, in a written statement to the House of Commons, confirmed that Porton had found no trichothecenes at all in any of its samples from supposed CBW attacks in Southeast Asia. Nor had any such samples yielded positive results in the French or Swedish defense laboratories where GC/MS had been used. The large-scale effort to verify the analyses of the nongovernment laboratories was careful and skilled. Set against this international laboratory endeavor, the positive reports of trichothecenes stood out as peculiarities: in the two

American nongovernment laboratories, 5 positives out of 6 environmental samples, contrasting with no positives out of more than 100 such samples examined in government laboratories. Contrasted with so many nonconfirmatory results and lacking the rigorous precautions taken in the government laboratories, the initial positive test reports no longer could be considered reliable.

There remained to consider the possibility that, in rather unusual circumstances, trichothecenes could occur naturally. The incidence and behavior in tropical regions of the molds that are capable of producing the toxins are not yet well known. Nevertheless, from the time of the West Berlin speech, the administration adamantly maintained that trichothecenes did not occur naturally in Southeast Asia. Under that assumption, now known to be incorrect, the occurrence of trichothecenes near a war zone might be construed as evidence of their use as weapons. A case in point is an episode in February 1982 at Ban Sa Tong, a Thai village 10 kilometers from the Cambodian border. The episode involved a sighting by villagers of an aircraft flying at high altitude and the appearance of numerous spots of yellow material on surfaces in a small area of the village. Neither deaths nor any abnormal incidence of clinical illness were associated with the episode. Under appropriate examination, the yellow spots later were shown to consist almost entirely of pollen. Some samples also showed very low levels of trichothecenes. A report by the Canadian government stated that the quantities of trichothecenes found in the yellow-spot material were "comparable to the levels reported worldwide for natural occurrences of trichothecenes on stored cereal."[6] In other words, there was a possibility that what had been measured in these samples was not residue but a background level of mycotoxin attributable to toxin-producing molds in the natural environment.

In August 1985 Canadian government investigators reported that a leaf sample collected at the site of the Ban Sa Tong episode was found to have a trichothecene-producing mold on it. Moreover, in May 1986 the Canadian government con-

[6] *J. J. Norman and J. G. Purdon*, Final Summary Report on the Investigation of "Yellow Rain" Samples from Southeast Asia, *Defence Research Establishment Ottawa report no. 912 (Ottawa, Canada, February 1986), 19.*

firmed that 2 years earlier its investigators had undertaken an extensive collection of blood samples in Thailand. Blood was taken from 270 individuals and analyzed for trichothecenes. Measurable levels of trichothecenes were found in the blood of 5 persons who had not claimed exposure and had not been in the vicinity of any alleged attack. Most recently, in April 1987, British government scientists at Porton reported the natural occurrence of trichothecenes in samples of food crops from Thailand. Despite what the U.S. government has previously asserted, these various findings indicate that trichothecenes do occasionally occur naturally in Southeast Asia.

The Defense-State Team

With the administration's explanation of yellow rain seen as insupportable, it remained to examine the meaning of the many cases of personal testimony that linked yellow rain to debilitating symptoms. Until late 1983, interviews with Hmong refugees and Khmer Rouge soldiers who claimed to have experienced CBW came from three sources. Personnel from the American embassy in Bangkok conducted interviews part-time; State Department and army investigators were sent out from Washington for several weeks in 1979; and, from 1981 to 1983, a retired American air force doctor and a British nurse-midwife interviewed alleged witnesses. There also were forays by the Canadian government, the United Nations, journalists, and others. By 1983 these various arrangements had produced a large volume of information—testimony that embassy officials regarded as variable and perhaps of dubious quality. The embassy repeatedly requested and Washington eventually supported a more systematic, full-time approach by specialists. As a result, a joint Defense-State CBW team was created in 1983. Consisting of an army chemical corps officer, an army medical officer (later replaced by a navy doctor), and a Foreign Service officer, the CBW team operated in Thailand for nearly 2 years, from November 1983 until October 1985.

Before the Defense-State CBW team arrived in Thailand, almost all of the refugees interviewed were selected for having said they witnessed chemical attacks. Individuals from the same areas of Laos who might have allowed independent cross-checking of chemical warfare stories were not

sought out. The supposed witnesses and the interpreters, often refugees themselves, generally knew in advance that the purpose of the interviews was to gather information about chemical warfare. The accounts were taken at face value; there was little attempt to double-check the stories by reinterviewing or to appreciate cultural differences between interviewers and respondents.

Documents recently declassified show that when the Defense-State CBW team began to address these matters, it discovered serious problems with the reliability of the previous interviews. For example, earlier interviews had failed to distinguish between firsthand observations and hearsay. Characteristic of the more careful approach taken by the CBW team was a report telegraphed back to Washington in January 1984. A Hmong man graphically told in an interview that he had seen "with his own eyes" chemical attacks on a village in Laos, had witnessed six deaths, and had suffered medical symptoms. But when reinterviewed by the CBW team and asked how he knew so much about attacks on the village while he was a resistance fighter in the distant jungle, he changed his account to say that he "did not personally see the attacks but rather had received accounts of the attacks from others." In another example, the team was able to locate a Hmong woman previously interviewed by the nurse-midwife. In that earlier interview, the woman was represented as saying that she had experienced a chemical attack and became ill from it. When reinterviewed by the team, the woman gave a different account: She confirmed that airplanes flew over her village every 2 or 3 days at high altitude but she denied ever having experienced chemical warfare. The team also interviewed a Hmong man who, when in a group, "told of gassing attacks but denied its reality when the interviewer talked to him alone outside."

The members of the CBW team also questioned people who had not been interviewed before. In May 1984 they interviewed a former resistance leader who had recently led a group of 93 other Hmong to Thailand. He had commanded about 40 men and their families living since 1975 on the slope of Phu Bia, the highest mountain in Laos. According to the reports of Haig and Shultz, most of the more than 200 chemical attacks said by

refugees to have occurred in Laos were in the vicinity of Phu Bia. But the CBW team reported in a telegram to Washington that

> he denied ever having experienced a CBW attack nor ever having seen any evidence of CBW use. When questioned why many other Hmong refugees related accounts of CBW attacks and he as a resident of Phu Bia for eight years had seen nothing [he] stated that he was an educated man who related what he saw and not what he felt. He added that other Hmong are different in that they relate what they hear and feel.

A grave problem came to light about the precision of dates specified in Hmong accounts. Many of the interviews relied upon in the Haig and Shultz reports specified the exact day of attacks, and secret intelligence intercepts were proclaimed to have confirmed the timing of these events. But, for example, when the CBW team reinterviewed three family groups from the same village in Laos, they could not agree on the date within a 4-month period or on the location of a yellow-rain incident to which they had testified earlier. In an April 1984 telegram the CBW team recognized the obstacle to resolving conflicting details: "The Hmong culture does not compartmentalize units of time as tightly as we who have broken our lives into seconds, minutes, hours and days. Their time blocks are by seasons and as a result any effort to confirm a specific date of a given incident is usually frustrated." Had earlier interviewers and interpreters helped the Hmong to stipulate Gregorian calendar dates? And, if so, what would this imply for the re-evaluation of information still classified?

Medical evidence to confirm Hmong and Khmer Rouge claims of chemical warfare was equally elusive. The army medical specialists sent to Thailand in 1979 relied on verbal accounts, not on medical examinations. In 1981 the embassy's regional medical officer examined purported Khmer and Hmong chemical warfare victims, but he found no clear evidence to support the allegations. Some doctors who had contact with refugees and Khmer Rouge soldiers noted various signs and symptoms that they thought possibly had resulted from exposure to toxic materials, but others interpreted them as indications of known tropical diseases, such as fungal infection, tuberculosis, or malaria, or attributed them to the effects of conventional warfare. At no time, then or

later, was any case documented in which diagnostic examination or autopsy provided clear evidence of exposure to chemical warfare agents.

This left the statements of Hmong refugees and Khmer Rouge soldiers claiming to have witnessed chemical warfare as the primary source of medical information. According to the Haig report, the interviews revealed a common symptomatology suggestive of trichothecene exposure. But simple examination of the army and State Department medical interviews shows that only 2 of the 60 alleged witnesses interviewed reported that particular constellation of symptoms. Over time this ratio did not increase. In a total of 217 interviews accumulated by 1984, only 5 matched the constellation of medical symptoms described in the Haig report.

In retrospect, the U.S. intelligence community departed from established procedures for verifying laboratory and field information and instead supported a conclusion that should have been regarded only as a hypothesis.

The medical investigations of the Defense-State CBW team in Thailand revealed no clear cases of exposure to chemical attack; its negative reports were nevertheless illuminating. Between December 1983 and May 1984, at least a dozen suspected chemical warfare attacks were reported to the team, but none yielded confirmatory evidence. For example, on several occasions the team investigated claims that Khmer Rouge soldiers had been gassed in combat. In a typical instance, cited in a February 1984 telegram to Washington, an extensive medical workup on an alleged victim who had complained of dizziness, nausea, and vomiting blood yielded this conclusion: "[His] symptoms, which he reported to be due to 'toxic gas exposure' could be easily explained by the clinical course resulting from the blast effects alone." In another case, in response to Bangkok newspaper stories that chemical attack victims had been admitted to a Khmer Rouge hospital, the team's chemical and medical officers went to investigate. Five patients complained of dizziness, vomiting, chest pain, and temporary unconsciousness, which they attributed to chemical attacks. After examining them, however, the team reported in a telegram to Washington, "We conclude that their symptoms were as a result of battle fatigue, smoke inhalation, heat stress, or a combination of these effects." A few days later, the Royal Thai Ministry of Defense, Supreme Command Headquarters notified the CBW team that additional chemical casualties had been admitted to the same hospital. The CBW team returned the next day accompanied by a Royal Thai Navy physician. This time there were four patients, complaining of the same symptoms as had the others. After investigating, the CBW team telegraphed Washington with the Thai physician's diagnosis that "all four victims suffered smoke inhalation and there was insufficient clinical evidence to support a finding of chemical weapons use."

The CBW team also investigated incidents closely resembling those investigated by Canadian physicians at Ban Sa Tong in 1982. In February 1984, four yellow-spot incidents were reported inside Thailand near Cambodia. Although Thai military officers and local villagers thought the events were CBW attacks, the team concluded otherwise. Its report to Washington stated, "In the team's opinion the lack of evidence of an explosive device, the small size of the area affected, and the seemingly selective distribution of spots [means] the incident appears to have been caused by insects or some other natural phenomena."

In sum, the administration's claim of toxin warfare rests on evidence that, over the past several years, has been discredited. In large measure, it was the systematic efforts of American government investigators that undermined the administration's case. The careful analytic work by U.S. Army chemists did not validate the initial reports of trichothecene toxins. Extensive and meticulous attempts by government laboratories in other countries also failed to confirm toxin warfare. The investigative work of the Defense-State CBW team in Thailand cast doubt on the entire body of evidence adduced from interviews with supposed witnesses. And the yellow-rain samples turned out to be the innocuous excrement of honeybees.

In retrospect, it is easy to see how the administration came to be in its present predicament. The U.S. intelligence community departed from

established procedures for verifying laboratory and field information and instead supported a conclusion that should have been regarded only as a hypothesis. Scientific issues obviously were central. Yet the administration ignored—indeed bypassed—the available institutional arrangements for obtaining high-level scientific advice. The president's science adviser, the Department of Defense Science Board, and the National Academy of Sciences were not asked to evaluate the evidence before policy was set. Instead, without carefully checking the claims of supposed witnesses, without obtaining independent corroboration of the toxin analyses, and without ascertaining the composition of the yellow rain, the Reagan administration chose to pursue a strategy of maximum public impact. The secretary of state's dramatic announcement in West Berlin in 1981 then locked the administration into a political position from which it has yet to extricate itself.