CHAPTER 4

The Chemical Platoon, the Abandoned Base, and the Village

Human Experiences of Multiple Toxic Timescapes in Vietnam

David Biggs

SINCE THE development of more toxic explosives and chemical weapons in World War I, war zones and military bases possess unique qualities as *toxic timescapes.* They are subjected to periods of intensive activity when unimaginably large quantities of hazardous, lethal materials are used. Depending on the timespan of a conflict or the lifetime of an active military base, knowledge of toxic exposures in surrounding communities may be severely limited by government secrecy. Partly in response to growing public attention to military toxics and partly in response to the end of the Cold War, a growing subfield of environmental history has emerged with a wide range of approaches to testing grounds, battlefields, military bases, and postwar recovery.[1] With increased declassification of military documents through the Vietnam era to 1975, historians now can produce incredibly detailed, pointillist-like studies of military operations and sites. This chapter takes advantage of this archive of materials on the US war in Vietnam to extrapolate the meaning of toxic timescapes characterized by the overlap of toxic spaces throughout time. The chapter draws on them to compare an almost microscopically focused view of military chemical operations with a contrasting, very murky local understanding of past operations.

Drawing upon archival research, site visits, and interviews, this chapter aims to do two things with respect to understanding the unique temporal and spatial features of toxic exposure in military spaces. First, by considering available military records more comprehensively, it challenges readers to move beyond narratives focused on a single contaminant toward a more holistic view of the totality of toxic releases and exposures happening in different periods of industrial and military time associated with production, logistics, and the use of toxic materials in combat.[2] The first part of this chapter situates one contaminant that has garnered the most attention from the Vietnam War, the tactical herbicide known as Agent Orange, in a broader flow of many different, toxic substances that were key to chemical warfare in Vietnam. Agent Orange and dioxin have drawn global attention to Vietnam as a case study of what some term "ecocide," with several million claims of exposure to the herbicide with degenerative diseases and birth defects in offspring. However, besides this controversial chemical, American troops and combatants in war zones were swimming in a veritable sea of other, toxic chemicals too. Daily life on military bases, and especially for Chemical Corps platoons, involved moving hundreds of drums of solvents, pesticides, explosives, incendiaries, and a powdered form of concentrated, "persistent" tear gas.

Second, after using archival and other sources to reconstruct this more holistic view of a few days in the life of a chemical platoon, this chapter turns to the base area for that platoon, a denuded hilltop near Huế, to illustrate the long-term effects of military occupation and toxic exposures even decades after the end of hostilities. Now almost fifty years since the base was closed (1972) and the war ended (1975), how has this hilltop that was a center for chemical operations over several years figured into local and regional histories of postwar recovery and development? Many former military bases where US chemical troops operated, including this hilltop near Huế, are today disappearing under tree plantations and industrial parks; but local knowledge of these sites and stories of exposure persist (as Antonova also points out in her chapter). The postwar story is complicated. There are scant public meetings or public remediation efforts; and the Vietnamese government still treats cleanups of Agent Orange and dioxin as state secrets. Contrasted with highly public, comprehensive cleanups at Vietnam-era bases in the United States, Okinawa, South Korea, and Europe, in Vietnam there are few visible signs or public records of cleanups. Besides popular,

propagandistic stories of nationwide exposures, only oral histories and local field studies provide more granular details describing individual experiences, doses, timing, and spaces of exposure.

Making Chemicals "Tactical" and the Commercial Side of Chemical Warfare

Histories of the herbicide Agent Orange and its use in Vietnam describe one of the most well-known examples of delayed toxic exposures from a war in the twentieth century; however, what few of these works acknowledge is that the same dioxin-containing herbicide in Agent Orange, 2,4,5-T, was by 1965 one of the most popular commercial herbicides in the world.[3] When US Air Force planes began spraying the herbicide over Vietnam in 1963, few questioned the toxicity of Agent Orange, given widespread familiarity with the component herbicides (2,4,5-T and 2,4-D) in agriculture, in landscaping, and even around home gardens. Unlike barrel bombs of napalm or tear gas dropped from helicopters, pesticides did not fit the bill of "chemical weapon." Most were available in commercial formulations at hardware stores. The US Army Chemical Corps designated a formulation for a "tactical" herbicide because American military planners felt the destruction of forest cover in Vietnam was key to "combat support."[4] Even in their "tactical" form, the herbicides in Agent Orange were barely different from commercial formulations available in farm supply stores and landscaping supply sheds. Aerial spraying of commercial herbicides was common in the US and Europe by 1965. What set apart the "tactical" herbicide was more the immense area sprayed and the presence of so many people in the spray path. The intensive use of the herbicide in this way meant that millions of people were exposed, usually by touching residues on leaves or equipment; however, the fact that several times the volume of the herbicide was being consumed globally meant that many more millions of people globally were exposed to Agent Orange's commercial cousins.[5] The same chemical formulation of 2,4,5-trichlorophenoxyacetic acid that killed trees in Vietnam could be found in slightly diluted concentrations in farm supply shops and grounds crew sheds around the industrialized (and industrializing) world, including the Soviet Union.[6] This specific chemical exposure—absorption of dioxin through exposure to 2,4,5-T

herbicides—may have been concentrated in the aerial spray paths in Vietnam but it was also happening globally along powerline rights of way, on roadsides, and on golf courses.[7]

This overlap between commercial and militarized pesticides is not unique to Agent Orange but rather had been a central feature of warfare science since World War II. Many herbicides and insecticides, including DDT, had dual fates as tactical chemicals considered vital to war efforts but also as "economic poisons" with commercial applications.[8] After the war was over in 1945, the US, UK, and other governments declassified new chemical formulations to promote their commercialization. With respect to pesticides, in only one well-documented incident did a government weaponize an insecticide specifically to kill people. German officers looking for "more humane" way to commit genocide employed mass quantities of the insecticide hydrocyanic acid (Zyklon B). This popular delousing agent was commercially available from the 1920s. Nazi scientists adapted it to their human-killing gas chambers at Auschwitz and other camps.[9]

The Agent Orange case is similar in one sense to the Nazi use of Zyklon B, namely for the relatively massive quantities of a commercial pesticide that had to be procured for the special mission; for several years, Agent Orange use in Vietnam accounted for almost half of all global production.[10]

However, despite the unprecedented volume of herbicides used in Vietnam, they still made up a small fraction of all US chemical operations in Vietnam. This point is made *not* to diminish the problem of dioxin exposure from herbicides but rather to better understand *past* bodily experiences of *total* chemical exposure in Vietnam. Troops and chemical platoons, especially, spent many days dropping vast supplies of other chemicals, particularly napalm and tear gas, from helicopters. Even if one includes all US Air Force flights dedicated to spraying several million liters of herbicides, the herbicide was just a small part of total chemical activities. Drops of napalm and tear gas dwarfed the herbicide missions in volume by several orders of magnitude. And daily drops of explosive munitions exceeded the tear gas and napalm drops by several more orders of magnitude. This plurality of toxic timescapes meant that humans—both combatants and civilians in the drop zones—were being routinely exposed to multiple toxins representing different pathways of exposure, different spatial and temporal regimes. Especially in war zones, exposure is rarely limited to one chemical.

To many Vietnamese old enough to have witnessed this destruction and to anyone who traveled through the region's ravaged hillsides before

their reforestation in the 2000s, this *total exposure* to the war—damage from bombing, incendiaries, tear gas, herbicides, and abandoned industrial operations—was widely apparent. The invisible spread of dioxins and other chemicals was unseen but repeatedly featured in news stories and local campaigns. Vietnamese accounts, especially works translated into English for foreign audiences, related stories of chemical drift, poisoned waters, and higher incidence of stillbirths and birth defects. Other work in the postwar era noted whole communities that formed to manage the salvage of unexploded munitions too.[11] After the war and especially with American veterans returning home, suspicious cancer clusters and incidences of birth defects suggested an invisible culprit; government news outlets repeatedly asserted this was the dioxin in Agent Orange. However, even fifty years later, no studies yet have definitively linked these illnesses to a past exposure to dioxin.[12]

In a series of research presentations for local officials in Huế and one at the US embassy in Hà Nội, I repeatedly showed how historical evidence pointed to a plurality of toxic exposures associated with a wide spectrum of chemical exposures; but both Vietnamese and American officials repeatedly emphasized a singular concern over Agent Orange.[13] In 2011, the United States and Vietnam had just settled on a plan for dioxin cleanups at former American air bases, as well as a plan to share data on bombing missions to locate unexploded ordnance. In my presentations, I suggested from my research that a few dozen American bases exhibited signs of pollution from multiple chemical hazards. Like their counterpart bases in the US, American bases in Vietnam dumped pesticides, solvents, lead paints, and other chemicals in unlined landfills.

Delayed manifestations of illnesses in veterans, offspring, and unwitting settlers around former "hotspots" continue to generate public outrage in Vietnam, but this outrage is repeatedly channeled into a single culprit: Agent Orange. Scholars such as Rob Nixon argue that such decades-delayed illnesses expose "the ultimate cover-up" with respect to governments willingly exposing civilians and their own soldiers to known toxic materials.[14] As I have noted elsewhere, the power and global reputation of this Agent Orange "cover-up" narrative may in itself be useful to state actors for obscuring what was a much broader exposure.[15] Global acceptance of the term "Agent Orange" handily distracts public attention from the more complex spaces of *comprehensive* toxic exposures formed at military bases and in war zones. This apparent willingness to limit research to certain

known dioxin reservoirs while ignoring comprehensive cleanups stems, I think, from the fact that other toxic timescapes associated with other contaminants such as hydrocarbons and solvents are now less easily identified with a single polluter such as the US military, since most former base areas have, since the early 2000s, found new life as industrial processing zones.

The Chemical Platoon and Archives of Toxic Exposure in the War Zone

In this unique political climate of hypersensitivity (to research on Agent Orange) and silence (regarding suggestions of multiple, intersecting toxic timescapes), historians can challenge these silences by writing environmental histories that do not reproduce the singular focus on one contaminant at the expense of others. The mostly declassified records of US forces in Vietnam offer a vast trove of public materials providing highly detailed accounts of chemical operations. There is perhaps no better place to begin than in the records of the US Army Chemical Corps, especially its chemical platoons assigned to bases throughout the country.[16] The job of a chemical platoon included both delivering tactical chemicals such as napalm, tear gas, and defoliants outside the base and carrying out "domestic" spraying inside base cantonments with DDT, anti-termite insecticides, and commercial (nontactical) herbicides. Were environmental engineers today to run comprehensive tests of soils at former chemical depot sites on American bases, they might detect a long array of toxic compounds besides dioxin. Storage yards for drummed napalm, Agent Orange, tear gas, and "tactical" chemicals often also housed quantities of commercial pesticides and any especially poisonous chemicals. Pads of concrete or asphalt beyond these drum yards were dispersal zones for chemical platoon soldiers (following guidelines at the time) to rinse drum residues before discarding the steel drums. The day-to-day activities of a chemical platoon and its associated wing of helicopters produced a daily swirl of "tactical" and "nontactical" exposures to fuels and lubricants, paints, solvents, pesticides, tactical herbicides, and thousands of drums of napalm, tear gas, and diesel.[17]

Compared to industrial pollution sites, one of the most unique features of military records on sites in Vietnam is their relative precision. The records of the US Military Assistance Command, Vietnam, and all of its component

units operating in Vietnam take up an area of several football fields of collapsing archival shelves containing hundreds of thousands of boxes running floor to ceiling. An army division such as the 101st Airborne, an organization of roughly fifteen thousand persons in Vietnam, operated like a small city in the Vietnam theater with departments for combat, logistics, engineering, intelligence, and planning. In the records for each subsidiary unit, one finds a mix of daily logs, after-action reports, and correspondence. Large encampments like the 101st Airborne's Camp Eagle (located near Huế in central Vietnam, 1968–72) added a Chemical Corps platoon to centrally manage the division's day-to-day tactical and nontactical chemicals.

The photographic records of the Chemical Corps, especially, provide detailed windows on the chemical war in Vietnam, explaining, for example, how the offensive work of a chemical platoon differed from other units, such as military police who used teargas (CS) but in far smaller quantities. The following photograph (figure 4.1) shows a chemical platoon loading drums of "persistent" tear gas (CS2) for a "bulk smoke drop," during which the exploding barrels would cover people and stick to underground walls, asphyxiating anyone inside.

FIGURE 4.1. Troops loading CS. Source: Box 17, Command Historian, Headquarters US Army Vietnam, RG472, NARA2.

This image provides useful clues for understanding the bodily nature of chemical operations and exposures in Vietnam. First, markings on the barrels detail their chemical contents. Companies in the United States manufactured and shipped these barrels following strict government procurement guidelines that required, in the case of persistent CS2, two stripes in the lower third ring of the barrel. All drummed chemicals featured visible cues, such as the orange-colored center ring for drums of Agent Orange, a white center ring for Agent White, and so on. Just visible on the top of the second barrel from right is a fuse protruding from the top. These were the white phosphorus fuses used to ignite the barrels when they hit the ground. Finally, the picture shows how close the bare-backed, enlisted soldiers came to these chemicals on a daily basis.

For every day that the Tenth Chemical Platoon was active in the war zone with the 101st Airborne Division, it recorded its activities in daily situation reports (sitreps) and after-action reports (AARs). These mission records detail not just the type and quantity of chemicals used but also coordinates of the target, purposes of the mission, and other details including pilot observations. The following records selected for one day, March 12, 1970, detail what was a typical day for the platoon:

> 1000–1115: 20 drums | flame drop—napalm | landing zone clearing
> 1115–1200: 10 drums | flame drop—napalm | bunkers and caves
> 1115–1245: UH1 "Huey" helicopter-borne sniffer mission | suspected encampments
> 1300–1400: UH1 "Huey" tactical CS-410 air-launched grenades | combat
> 1300–1530: UH1 "Huey" helicopter-borne sniffer missions (3 flights) | encampments
> 1315–1545: 60 drums | smoke drop—persistent CS—from 7200 feet | suspected base area
> 1530–1730: 20 drums | flame drop—napalm | cave area[18]

The flight logs for that day did not include a defoliation mission, but the Tenth Chemical almost weekly used a specially rigged Huey helicopter outfitted with a 110-gallon tank and spray rigs to spray Agent Orange or other defoliants (Agent White, Agent Blue) around base perimeters. On March 13, however, the US Air Force squadron responsible for flying fixed-wing defoliation missions sent two planes over the 101st's area of operations to spray 3,000 gallons of Agent Orange along

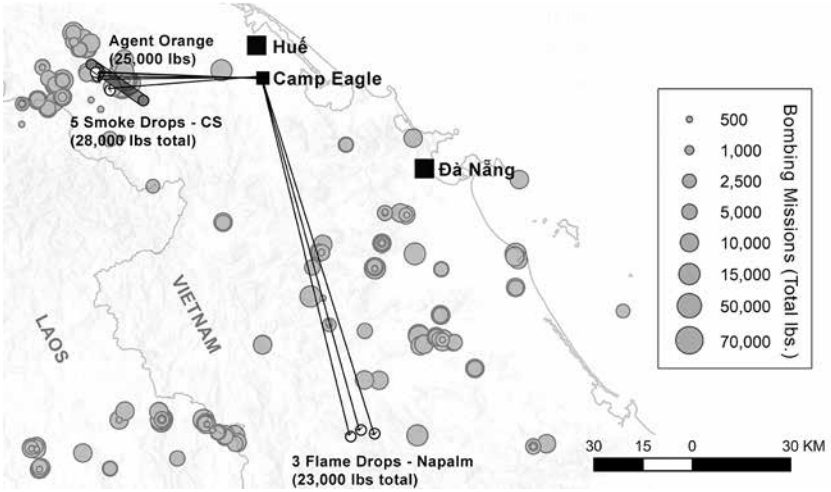

FIGURE 4.2. The Tenth Chemical Platoon's daily missions, March 12, 1970, and all bombing and defoliation, March 12–13, 1970. Figure by author. Map software courtesy of ESRI, Inc.

a path approximately nineteen kilometers long and one kilometer wide (figure 4.2).

This list of missions shows the daily variation in chemical operations and relative scale, but mapping the platoon's activity with all other documented American bombing and defoliation over just two days, March 12–13, 1970, shows a more comprehensive picture of the space of these exposures taking place at just one moment in a war that lasted almost ten years. In just the area of the map (figure 4.2) for these two days, US planes flew 261 missions dropping over 1.3 million pounds of conventional explosives.[19]

The area in the top left of this map shows a particularly concentrated area of bombing. Zooming in to this area (figure 4.3) and adding a terrain and ground cover layer, we can see that the target of this concentrated bombing, defoliation, and CS "smoke drops" was a set of hillsides fringing an upland mountain valley, the A Sầu Valley, that was a major entry point for North Vietnamese troops traveling southward on the Ho Chi Minh Trail. The orange line denotes the spray path of the two Air Force planes dropping Agent Orange.

The steep terrain and the layering of bombing with chemical drops point to the complexity of this particular landscape with respect to toxic exposures. The map also indicates the surreal degree of precision

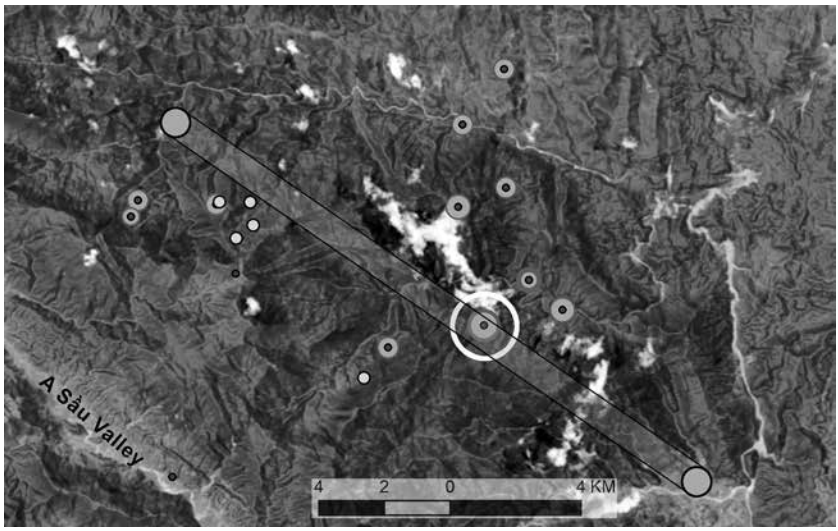

FIGURE 4.3. Chemical missions and bombing, March 12–13, 1970. Figure by author. Map construction courtesy of ESRI, Inc.

with which historians and geographers can, using public data, model particular toxic exposures associated with US military activity to a particular day or two, even particular hours, in a drop zone roughly one to two kilometers in area. However, even this cartographic representation is misleading because often multiple bombing missions with multiple planes dropped on the same target. The circled bomb mission in the map actually represents the following two bombing missions (figure 4.4):

Latitude	Longitude	Date	Num_ Acrft	Aircraft	Load_ Qty	Ordnance	Ord_Class	Category
16.34368	107.28869	3/13/70	3	B-52 D	72	1000 LB GPB M-65 A-1	1000LB MK-65	Gen Purpose
16.34368	107.28869	3/13/70	3	B-52 D	72	750 LB General Purpose Bomb	750LB MK-117	Gen Purpose

FIGURE 4.4. Excerpt from THOR GIS. Figure by author. Map software courtesy of ESRI, Inc.

This figure tells us that on March 13, six B-52 "Superfortress" bombers dropped a total of 126,000 pounds of bombs (57 metric tons) on this site.

Hupy and Koehler have also shown how intensive bombing reconfigured the terrains through which toxic chemicals either dispersed

or concentrated in reservoirs. They examine the lines of bomb craters produced from "carpet bombing" with craters more than twenty meters in diameter, noting long-term consequences for the geomorphology of the region.[20] They introduce a new term, *bombturbation,* to describe such intensive, bombing-related alteration of topography. Especially in mountainous regions of Vietnam, bombing radically altered sediment transport, mesotopography, and pathways for revegetation given massive loss of topsoil. Add to this cratering effect the collection of residues of Agent Orange or unexploded drums of CS, and one can develop a more complete picture of specific points in the war zones as multilayered toxic timescapes.

While Vietnamese military documents are mostly not public, military histories of the People's Army nevertheless show that the Americans were not the only ones introducing potential toxicants into this environment. A history of the Trương Sơn Route (Ho Chi Minh Trail) lists the following components of a military command made up of roughly fifty thousand men and women working at "17 military stations" with "22 vehicle battalions, 4 mobile anti-aircraft regiments and eight anti-aircraft battalions," as well as combat units and finally "two regiments of gasoline pipeline troops."[21]

Contrary to popular American depictions of their Vietnamese opponents as shadowy figures hiding in the jungle with only a rifle, the reality of the communist effort, especially by 1970, was more one of a city on the move. Supply lines of troops supplied with Russian and Chinese equipment fanned out in streams along mountain trails and rejoined at designated supply points in Laos. Like the US Army at Camp Eagle, they produced new towns at these key junction points.[22]

In the decades since the war ended in 1975, most Vietnamese records of life in the war zone appear in movies and fiction. Lê Minh Khuê (1997), a veteran of an all-female youth brigade supporting the Trương Sơn Command on the trail, writes terse, Hemingway-like short stories depicting lives shattered amidst images of moonscapes produced by bomb craters. Even today, news clips and television documentaries often visually refer to black-and-white pans across apocalypse-like destruction in the mountains, though generally the aim of these shows is to contrast wartime destruction with today's "regreened" (*phủ xanh*) hillsides now covered in blankets of industrial forests or cash crops such as tea and coffee.[23]

The Village, the Hill, and the Base

After the war's end in 1975, amidst a backdrop of denuded hills and dead trees, stories of Agent Orange continued to circulate while the Vietnamese government strictly limited most overtures of foreign aid to support comprehensive toxicological research. The US trade embargo against Vietnam prevented meaningful exchanges between American and Vietnamese scientists before 1994. Meanwhile in 1991, the US Congress passed the Agent Orange Act to direct the Veterans Administration to treat American veterans.[24] At the same time, the US Environmental Protection Agency included several dozen Vietnam-era bases *inside* United States territory on its National Priority List for comprehensive toxic cleanup.[25] The normalization of US-Vietnam relations led to more public, multinational investigations but solely at the well-known Agent Orange hotspots. In 1996 and 1997, a Canadian-Vietnamese team visited the A Shau Valley to test for dioxin at sites in the mountains. Along the cratered hillsides where planes had sprayed, they found traces of TCDD dioxin comparable to background levels on American golf courses, zero to five parts per trillion. However, at one former base in the valley where the herbicide was stored in drums and presumably released into bomb craters after the base's evacuation, the team found spikes of dioxin contamination and traced it from the ponds to ducks and fish and to human fat tissue, especially breast milk.[26] As US-Vietnam relations improved in the first decade of the twenty-first century, the Ford Foundation's first Vietnam director in Hanoi worked with government representatives and scientists to establish a public "dialogue" aimed at remediating what most agreed were the priority polluted sites, the former airbases that stockpiled herbicides.[27]

While the United States has now committed several hundred million dollars to cleaning up the dioxin hotspots at several former air bases, very little of this international dialogue has ventured beyond Agent Orange and dioxin to include comprehensive cleanups at the dozens of former bases like Camp Eagle. Were the United States to pay for comprehensive remedial investigations and cleanup, the cost at each larger base site might reach one billion US dollars; considering that the United States operated several dozen major base sites, a total cost for comprehensive toxic cleanup might top thirty billion dollars.[28] There are, of course, complicating factors beyond the reluctance of American leaders and

the US Congress to spend such a sum. For one, many former base sites are now repurposed as industrial parks; for another, such assistance is inevitably tied up with fast-evolving, new defense arrangements between the United States and Vietnam. Finally, in a country where the average annual income approaches 6,000 US dollars, the scale of such a comprehensive cleanup is so unimaginable it rarely enters public discussion.

And yet, just like the highly detailed accounts of daily chemical and bombing missions, there is a detailed archive describing each individual military base with maps of landfills, chemical depots, maintenance facilities, and the like. There is also photography, even satellite photography, that one can use to detect the footprints of sites like the Tenth Chemical's depot, with its rinse pads and the helicopter pad where Hueys and CH-47s departed on daily missions.

Applied Toxic Timescape Research

Given these high-level political and economic constraints, it is unlikely that either government will carry out remedial investigations at these sites; but there is nevertheless important value in drawing on publicly available sources to, if nothing else, provide information to local stakeholders. It was largely thanks to local government interest in obtaining this information that I was able from 2007 to 2011 to carry out site visits, oral histories, and local research around one military area near Huế in central Vietnam. This area had minimal association with the Agent Orange hotspots, but beginning in 2000, the local government had struggled with periodic discoveries of buried chemicals, especially persistent CS. I set out an applied project to detail, in the manner of comprehensive remedial investigations, the toxic history of these bases. In researching base closure records at the National Archives, I discovered highly detailed air photos, maps, and other records detailing landfills, chemical storage depots, and other facilities. Like many American bases, this one closed abruptly in December 1971 as the US military began drawing down troops. In less than one month, all of the units assigned to the base (including the Tenth Chemical Platoon) returned to the United States. Figure 4.5 shows the ghost town left behind as the South Vietnamese military took possession of the base property.

FIGURE 4.5. MACV Base Turnover Files, Camp Eagle. Source: NARA2, RG472, MACV Construction Directorate, Real Property Disposal Files, Box 3. Map software courtesy of ESRI, Inc.

This almost-domestic scene, a man standing with two dogs in the foreground, also contains evidence of the fate of the emptied drums used by the thousands to deliver fuel and chemicals to Camp Eagle. Troops used them as fire bins for burning organic waste or, more commonly, as makeshift barriers against shrapnel along the walls of barracks. A row of drums is just visible in the background behind the man.

To the world press, US officials noted that as part of the Vietnamization strategy, the bases would soon be filled by thousands of Vietnamese soldiers who would continue to prosecute the war. Privately, however, both US and South Vietnamese officials acknowledged that the base turnover was a hasty, improvised, total abandonment of these spaces. American forces removed perimeter lighting systems, air conditioners, water-treatment systems, fencing, electrical generators, medical equipment, helicopters, guns, communications equipment, and so on. The base they turned over was a defenseless shell. Things they did not remove included several years' worth of industrial waste in the base landfill and years' worth of chemical residues spilled over the hillside. Stocks of containerized napalm and CS presumably found new applications with the South Vietnamese military, but unearthed caches of CS in the area suggest either the Americans or the South Vietnamese buried unused stocks in pits.[29]

Combining text records with historic air photos and satellite imagery permitted me to pinpoint the facilities of the Tenth Chemical Platoon

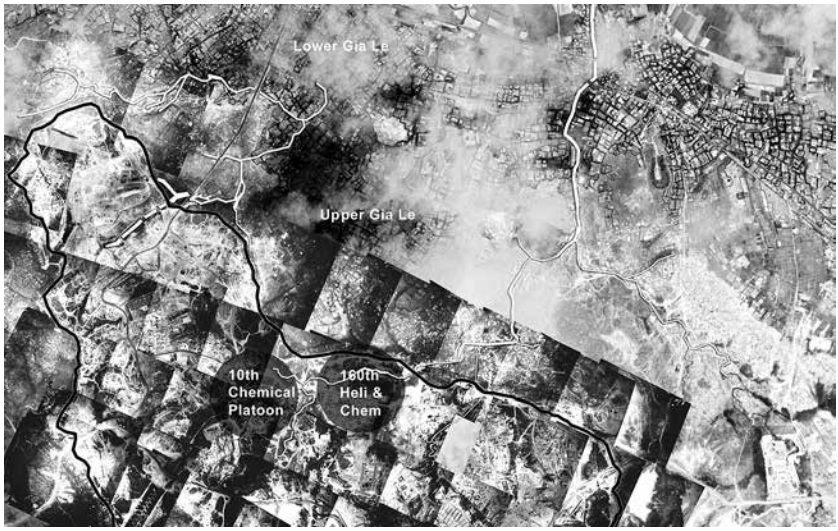

FIGURE 4.6. Photomosaic and satellite imagery, 1972, showing Camp Eagle cantonment with added detail of base boundary (black) and streams (white). Sources: Box 3, Military Assistance Command Vietnam Construction Directorate, Real Property Disposal Files, RG472, NARA2 and CORONA Frame DS1117–2038DF144, courtesy of US Geological Survey, Earth Resources Observation and Science Center. Image by author. Map construction courtesy of ESRI, Inc.

as well as landfills and potential spill sites; showing it in relationship to stream drainage and nearby village lands permitted a more focused view on areas most likely to be impacted by toxic runoff. Figure 4.6 shows the base boundary in red with streams in blue and village fields and homes located to the north (and downstream).

This juxtaposition of chemical operations and hazardous chemical storage along a stream drainage was not accidental. The siting of the Tenth Chemical Platoon with pads for drummed chemicals next to the 160th Helicopter Battalion that carried them reflected a common military and industrial practice of the mid-1960s, using natural drainage pathways to dump waste—fuel runoff, pesticide residues, herbicides, and excess from the steel drums. The disposal protocol of the day was to wash these residues off the asphalt-covered helipad or drum field into the stream below.

For almost thirty years after the base closed, there was little effort to regreen this landscape. As a military property, the base area transferred in 1975 to the conquering People's Army. Suddenly overwhelmed with

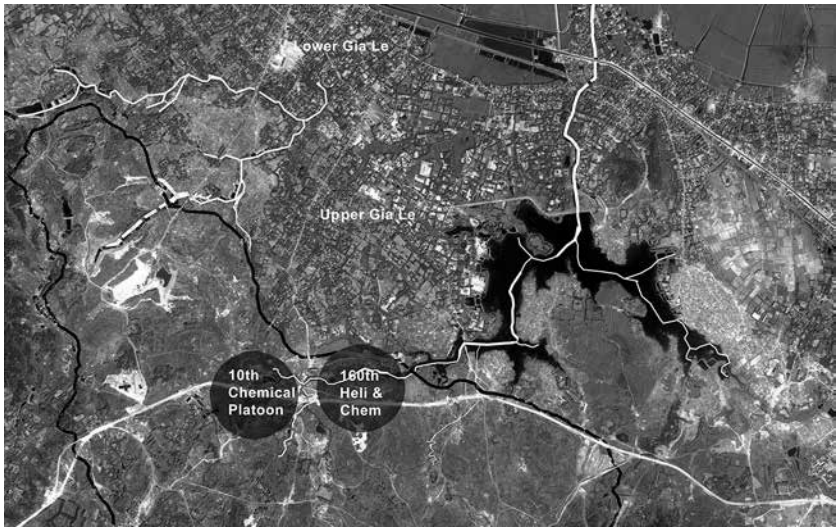

FIGURE 4.7. 2002 IKONOS satellite image with annotations added by author. Source: IKONOS-2 satellite frame, courtesy of GeoEye Foundation. Map software courtesy of ESRI, Inc.

so many inherited base properties, the People's Army made little effort to manage such spaces that, under a reunified government, had little strategic value.

The following (multispectral) satellite image taken in 2002, adjusted to show an infrared layer, details the still-denuded hilltops and outlines of buildings on the base and a new, potentially complicated addition to the village landscape: a reservoir.

Built to supply village fields with water throughout the dry season, these reservoirs have become focal points for toxic finds. Just as in the A Shau Valley, the muddy silt at the base of reservoirs is often contaminated with heavy metals and other toxic molecules, such as dioxin, that settle into the mud. When local workers periodically clean these shallow lakes, they often discover (sometimes with fatal consequences) waste drums from the base lands above.

As the pace of economic development has accelerated rapidly in Vietnam since the early 2000s, the number of these discoveries has increased. In January 2000, workers at a similar reservoir a few kilometers away excavated about a dozen fifty-five-gallon drums of discarded CS_2. Assuming the drums were empty, they punctured them with shovels and then accidentally inhaled the caustic powder. Several later died at the

hospital with holes in their lungs and esophagus.[30] These toxic events, rarely attracting much interest from Hanoi or abroad, nevertheless catalyze local and provincial governments to take a more comprehensive approach to the toxic timescapes of the base. Agent Orange research has continued at three still-functioning airbases, but the overwhelming majority of former military landscapes are left for local governments and villages to manage.

In the course of interviews with local experts and village residents, many of whom recounted stories of individuals in their families with unusual birth defects and cancers, I quickly began to realize a number of complexities in attempting to link stories of sickness to the chemical wastes in the hills above.

Mobile People, Mobile Chemicals

Returning to the issue of bodily experiences in these multilayered, complex toxic timescapes, we see that another challenge in identifying the source of a person's exposure stems from the fact that people moved long distances during the war years and especially after, as over a million people left Vietnam as refugees. Many Vietnamese veterans, women and men, left their home villages as youth and traveled hundreds if not thousands of kilometers for military service over several years. One resident, Mr. Minh (born 1925), recounted how he joined the Việt Minh before 1954, traveled to Hà Nội for training, then in the 1960s managed a key ferry crossing on the Ho Chi Minh Trail in Laos. He was sprayed with Agent Orange there; and he blamed his son's severely deformed legs on his exposure to the herbicide.[31] As with so many veterans, he believed this toxic exposure in Laos brought genetic damage in his children. This realization—that one's body carries the chemical imprints of exposures from elsewhere—highlights a major concern for veterans and their offspring who are unsure whether toxic exposures have occurred far away in former battle zones or through daily, small-dose exposure from drinking water in the village.

Returning to a broader theme in this volume, how are we to characterize these bodily dimensions of toxic timescapes when persons such as Mr. Minh, postwar settlers, and refugees were moving such great distances? As Mr. Minh recounted tales of his travels during the war

and experiences with the postwar settlers in the "dead" hills above the village, I quickly dissolved my *static* picture of village life derived from so much colonial anthropology and postcolonial, nationalist writing about the countryside.

In this chapter I have focused on the stories that historians can construct about a toxic past. In the case of the chemical platoon and its base in central Vietnam, reconstructing multiple toxic timescapes of the American chemical war challenges a tendency to obfuscate this reality through a singular focus on Agent Orange. The extent and effects of herbicide spraying are highly visible in the media, less so the landscape today; and there remains a deep sense of injustice among millions of Vietnamese who, like Mr. Minh, believe their suffering is directly tied to encounters with this chemical. However, from the perspective of constructing toxic histories, the nationwide if not global association between Vietnam and Agent Orange is troubling. Does it not distract attention from the more complex chemical environments and ecosystems of the war zone? The moral story of Agent Orange is clear, but getting at more complex histories of the herbicide's place in the war zone and the world requires deconstruction of this monotoxic tale. Outside of Vietnam, tens of millions of people traveled through environments treated with the same chemical, and its contaminants, as that in Agent Orange. In the war zone, people moved through environments touched by more than a dozen potentially toxic or lethal chemicals. What makes the Agent Orange story so salient is its boundedness. There are discrete boundaries of spray paths, and records of spray missions with specifics on date, location, and volumes used. The specificity of historical records such as the Tenth Chemical Platoon's daily missions challenges this singular focus with highly detailed mappings of all sorts of chemical activity, a day in the war zone.

My ethnographic and site-based studies also revealed other "blind spots" having less to do with a focus on a specific chemical than my tendency to focus on this site during just one "toxic" war. The lens through which I originally understood this base footprint was almost wholly colored by American records, air photos, and maps. Like so many colonial ethnographers, I read this landscape through this archival framing. This exceptional or colonial bias presents problems for developing more comprehensive understandings of toxic timescapes, as Kate Wright's chapter

(this volume) makes clear in her study of Indigenous ontologies of time. The military base in my study, like most of those occupied by Americans in the 1960s, was not "carved out of nature." Ethnographic research gradually shifted my focus from locating toxic exposures within the American period to placing American-era episodes in a more layered history of ecological ruptures and sociopolitical responses to areas described as "dead" land since the early 1800s.[32] The conditions that produced the base and its frequent releases of napalm, CS, fuels, and pesticides were historically and socially situated in "dead land" long separated from other spaces. Taking this "Indigenous ontology" and thinking forward in time, 1960s toxicity has in turn produced ideal conditions for new state and private interests to locate new, potentially toxic ventures here.

My initial blind spot on "American exceptionalism" opened up further questions about how such toxic timescapes fit into longer histories of what Scott terms the grid-based logic of state building.[33] Base expansions were limited to lands described locally as "wasteland" (*đất bỏ hoang*), but in a country where land is scarce, even "dead" or "waste" land has important uses. This dynamic nature of "waste" areas associated with multilayered toxic timescapes deserves greater attention. In ten years of research trips, I watched some sites identified as potentially toxic transform with a new mix of military and industrial enterprises. The grid logic of the abandoned American base with its sewer, water, and electric lines was reborn into an export processing zone.

Ethnographic studies of polluted places expose cracks in one's critical lenses and shortcomings for historians who rely almost solely on archives. Truly aligning one's research with a toxic landscape and timescape may mean abandoning certain moral frameworks in which toxicity is constructed too. A preoccupation with the American military activities of the Tenth Chemical Platoon obscures a longer, more dynamic interplay between military and industrial polluters at the site.

Acknowledging these rich pockets of chemical history as well as critical blind spots, how might this kind of multilayered analysis "do work" for other researchers or at other sites? Situating studies of toxicity in less static, more historically dynamic spaces subject to shifting human experiences and activities may allow for a more rhizomic approach to understanding how toxicity, such as dioxin exposures or persistent CS, travels through nature and through living bodies. Toxic exposures in the war zones of Vietnam and in the villages produced distinctive metabolic

and social ruptures. Deforestation and the creation of "wasteland" in the hills produced "openings" for successive industrial occupation too. The value of this multilayered or rhizomic approach is that it does not diminish the importance of fine-grained, individual actions; rather, it places them in a more dynamic context.

Notes

1. Richard Tucker and Edmund Russell's *Natural Enemy, Natural Ally* (2004) offers a useful early synthesis of early ideas in this trend, particularly examining areas where military research such as in pesticides has general spillover effects in civilian life. Since then, there have been too many works to summarize, but suffice to say that scholars, especially historians, have opened up fascinating comparative studies, such as historian Kate Brown's *Plutopia: Nuclear Families, Atomic Cities, and the Great Soviet and American Plutonium Disasters* (Oxford: Oxford University Press, 2015), and creative approaches to secret spaces, such as geographer and artist Trevor Paglen's *Blank Spots on the Map: The Dark Geography of the Pentagon's Secret World* (New York: New American Library, 2014).
2. A similar point about several contaminants defining toxic spaces versus one singular contaminant dominating the media narrative is made by Iris Borowy in this volume.
3. Recent histories of Agent Orange include Martini's (2012) and Zierler's (2011) histories of the development of Agent Orange and its unusual use as a tactical herbicide in Vietnam. Alvin Young (2009), a US Air Force herbicide researcher, has published one of the most comprehensive guides to Department of Defense records. Stellman et al. (2003) have for more than thirty years focused on problems associated with US veterans' exposure and attributed health problems. Historian Robert Neer (2013) has published one of the first histories of the incendiary napalm, while various researchers including Vatthana Pholsena and Oliver Tappe (2013) have focused studies on regional responses to problems posed by unexploded ordnance.
4. See Alvin Young, *The History, Use, Disposition and Environmental Fate of Agent Orange* (New York: Springer, 2009), 62–63.
5. For estimates of Vietnamese exposures, see Jeanne M. Stellman and Steven D. Stellman, "Agent Orange during the Vietnam War: The Lingering Issue of Its Civilian and Military Health Impact," *American Journal of Public Health.* 108, no. 6 (2018): 726–28. Their estimates of people exposed, including Vietnamese civilians, Americans, and foreign persons, range from 2.1 to 4.8 million.

6. See John Jake Ryan and Arnold Schecter, "Exposure of Russian Phenoxy Herbicide Producers to Dioxins," *Journal of Occupational and Environmental Medicine* 42, no. 9 (2000): 861–70.
7. There is extensive scientific literature on the history of dioxin exposures in commercial plants producing 2,4,5-T in such places as Nitro, West Virginia, USA (1949); Ludwigshafen, Rhineland-Palatinate, Germany (1953); and Seveso, Lombardy, Italy (1976). For a concise overview, see Roland Weber, Mats Tysklind, and Caroline Gaus, "Dioxin: Contemporary and Future Challenges of Historical Legacies (Editorial, Dedicated to Otto Hutzinger)," *Environmental Science and Pollution Research* 15, no. 2 (2008): 96–100.
8. The term *economic poison* is used in US laws to describe pesticides. Passed in 1947 as many war-era chemicals were coming on the market, the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) described pesticides, including herbicides, as "economic poisons." Synthetic auxin herbicides such as 2,4,5-T and 2,4-D were added to this list in an August 7, 1959 Amendment. See United States Environmental Protection Agency, *Legal Compilation: Statutes and Legislative History, Executive Orders, Regulations, Guidelines and Reports* (Washington, DC: GPO, 1973), 47, 89.
9. Nestar Russell, "The Nazi's Pursuit for a 'Humane' Method of Killing," in *Understanding Willing Participants, Volume 2: Milgram's Obedience Experiments and the Holocaust* (London: Springer, 2019), 241–76.
10. This estimate is based on calculations using US Tariff Commission Reports and the US Department of Agriculture's annual *Pesticide Review.* See also David Biggs, "Following Dioxin's Drift: Agent Orange Stories and the Challenge of Metabolic History," *International Review of Environmental History* 4, no. 1 (2018): 18–20.
11. Examples of English-language accounts include Trần Mai Nam's *The Narrow Strip of Land (The Story of a Journey)* (Hanoi: Foreign Languages Publishing House, 1969). For a discussion of North Vietnamese radio broadcasts and newspaper stories about toxic exposures, see Historical Working Group, "Herbicide Operations in the Republic of Vietnam," Box 8, Historians Background Material Files, MACV Secretary of the Joint Staff (MACJ03), RG472, US National Archives. For her study on postwar salvage, see Christina Schwenkel, "War Debris in Postwar Society: Managing Risk and Uncertainty in the DMZ," in *Interactions with a Violent Past: Reading Post-Conflict Landscapes in Cambodia, Laos and Vietnam,* ed. Vatthana Pholsena and Oliver Tappe (Singapore: National University of Singapore Press, 2013), 135–56.
12. For a comprehensive history of the many legal battles and scientific studies, see Edwin Martini, *Agent Orange: History, Science and the Politics of Uncertainty* (Amherst: University of Massachusetts Press, 2012).
13. Details of that research are described in David Biggs, *Footprints of War: Militarized Landscapes in Vietnam* (Seattle: University of Washington Press, 2018), 189–96.

14. Rob Nixon, *Slow Violence and the Environmentalism of the Poor* (Cambridge, MA: Harvard University Press, 2013), 210–11.
15. Biggs, "Following Dioxin's Drift," 30.
16. The US Army Chemical Corps attached chemical platoons and chemical companies to army combat divisions in Vietnam. Most of these records are contained within the series Chemical Units, United States Army, Vietnam, Records of US Forces in Southeast Asia, Record Group 472. The materials discussed in this chapter focus on one chemical unit, the Tenth Chemical Platoon. Its daily logs are held in two locations: the Chemical Officer Daily Journal, 101st Airborne Division, United States Army Vietnam, RG472, and Tenth Chemical Platoon, Chemical Units, U.S. Army, Vietnam, RG472.
17. These activities are detailed in chemical platoon records as well as in historic aerial photography showing locations of chemical depots on US bases. The air photography is located within base closure records compiled by the Real Property Management Division: see Property Disposal Files, Construction Directorate, Military Assistance Command, Vietnam, RG472. Disposal techniques from that era followed US Department of Defense Disposal Manuals. See, for example, US Department of Defense, *Defense Disposal Manual* (Alexandria, VA: Defense Supply Agency, 1964).
18. See Boxes 2–3, Chemical Officer Daily Journal, 101st Airborne Division, RG472, NARA2.
19. Data on individual US bombing missions were found at the US Air Force Research Institute's THOR: Theater History of Operations Reports at http://afri.au.af.mil/thor/index.asp. This dataset has since been moved to https://data.world/datamil/vietnam-war-thor-data. For an essay describing the dataset, see Sarah Loicano, "Historic Airpower Database Now Online," US Air Force, August 9, 2013, www.af.mil/News/ArticleDisplay/tabid/223/Article/466817/historic-airpower-database-now-online.aspx.
20. Joseph Hupy and Thomas Koehler, "Modern Warfare as a Significant Form of Zoogeomorphic Disturbance upon the Landscape," *Geomorphology* 157 (July 2012): 169–82.
21. Đồng Sĩ Nguyễn, *The Trans-Trường Sơn Route: A Memoir* (Hà Nội: Thế Giới Publishers, 2005), 143.
22. Đồng Sĩ Nguyễn, 143.
23. Lê Minh Khuê, *The Stars, The Earth, The River* (Chicago: Northwestern University Press, 2005). See, for example, her story "A Day on the Road," about the Youth Brigades working to maintain portions of the Ho Chi Minh Trail, pp. 37–54. There is also a sizable literature in Vietnamese memoirs and official histories of this work. See Hội Nhà Văn Việt Nam, *Đường Hồ Chí Minh: Hồi Kỳ của nhiều tắc giả* [Ho Chi Minh Trail: Memoirs by many authors] (Hanoi: Nhà Xuất Bản Tác Phẩm Mới, 1982).
24. See Martini, *Agent Orange,* 190–96.

25. The Comprehensive Environmental Response, Compensation, and Liability Act (1980; also known as the Superfund Act) established a procedure for investigating and cleaning up toxic waste sites. The National Priorities List indicated those sites deemed the most hazardous. More than half of the sites on this list by 1991 were military bases.
26. L. Wayne Dwernychuk et al., "Dioxin Reservoirs in Southern Vietnam—A Legacy of Agent Orange," *Chemosphere* 47 (2002): 121.
27. Le Ke Son and Charles Bailey, *From Enemies to Partners: Vietnam, the U.S. and Agent Orange* (Chicago: G. Anton, 2018).
28. I derive this only as a rough estimate based on figures for major cleanup efforts at former and active US bases in the United States. Jonathan Wargo tallies the cost for a two-decade-long cleanup at the Massachusetts Military Reservation at over 750 million US dollars.
29. "Eagle Turnover," January 16, 1972, Box 3, Real Property Management Division, Property Disposal Files, Military Assistance Command, Vietnam, RG472.
30. This event is described in Province People's Committee Decree 272, January 26, 2000. More recently, the Vietnamese daily *Pháp Luật VN* returned to investigate alleged cancer clusters around the pollution site. See Thủy Nhung, "Nghi vấn thảm họa ung thư từ hầm chứa chất độc CS v. kho trữ thuốc trừ sụ," Pháp Luật VN, August 18, 2016, https://www.baomoi.com/nghi-van-tham-hoa-ung-thu-tu-ham-chua-chat-doc-cs-va-kho-tru-thuoc-tru-sau/c/20119429.epi.
31. Minh, interview by author, January 18, 2012.
32. This more layered approach to militarized landscapes is the subject of my book *Footprints of War: Militarized Landscapes in Vietnam* (Seattle: University of Washington Press, 2018).
33. James Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven, CT: Yale University Press, 1998), 49–52.