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Chemical weapons: Buried in the backyard

By Jonathan B. Tucker

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In the northwest corner of the District of Columbia, sandwiched between the Potomac River and the Maryland state line, is an affluent enclave of elegant homes and tree-lined streets known as Spring Valley. This neighborhood is home to some 13,000 people, including members of Washington's political and financial elite. The 660-acre community includes approximately 1,200 houses valued at between \$600,000 and \$1 million, along with the campus of American University, schools, churches, a hospital, foreign embassies, and a theological seminary. Beyond its reputation as a quiet, upscale neighborhood, Spring Valley has a less desirable attribute: It is the only residential area in the United States where a major chemical weapons cleanup operation is under way.

During World War I, much of what later became the Spring Valley neighborhood was devoted to the development and testing of chemical weapons, a fact that was largely forgotten during its subsequent residential development.

But the past came back to haunt Spring Valley on January 5, 1993, when a backhoe digging a sewer line in front of a recently constructed house in a luxury development uncovered a cache of rusted munitions, including four unexploded mortar rounds and three 75-millimeter artillery shells. [1] Within hours, army bomb-removal specialists wearing gas masks arrived by helicopter from Aberdeen Proving Group in Maryland. They determined that the mortar rounds still had fuses in them--that they were "live" and extremely dangerous. Some of the munitions were also believed to contain mustard agent, an oily liquid that causes painful and debilitating burns and blisters on the skin and can inflict fatal lung damage if inhaled. Today, eight years later, additional chemical weapon dump sites have been discovered in Spring Valley, and the cleanup continues.

The contamination of Spring Valley provides a dramatic example of the problem of chemical weapons that were disposed of decades ago by burial on land or dumping at sea. Although the United States, Russia, and other countries are currently struggling to rid themselves of their declared military stockpiles of chemical weapons, which total more than 70,000 metric tons, those stockpiles are only the tip of the iceberg. Hundreds of thousands of tons of deteriorating chemical munitions left in unmarked burial sites or dumped at sea pose a far greater threat to public health and the environment.

Buried history

Spring Valley was largely unsettled until the start of the Civil War. After an act of Congress chartered American University in 1893, construction of its first building began in 1896. Because it took several years to secure financial support and to hire teachers, however, the first class was not admitted until 1914 and the first degrees not awarded until 1916.

On April 6, 1917, the United States declared war on Germany and entered World War I. In support of the war effort, the trustees of American University offered the government the rent-

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free use of the campus and facilities, which were then surrounded by open fields and woods.

Meanwhile, on the battlefields of Europe, Germany had begun to employ new and more deadly forms of chemical warfare. Although the Germans had been using toxic gases such as chlorine since 1915, in 1917 they introduced mustard agent, which was far more persistent and militarily effective. Three months after intervening in the conflict, the United States began a crash program to develop mustard and other highly toxic chemicals. (Some historians have likened the urgency and scale of the World War I chemical weapons development effort to the World War II Manhattan Project that resulted in the atomic bomb.)

The Chemical Warfare Service of the U.S. Bureau of Mines leased 92 acres from American University to create a new research facility called the American University Experiment Station, where some 1,200 scientists and engineers developed, synthesized, and tested 48 different chemicals for possible use in gas warfare. Hundreds of pounds of toxic compounds containing mustard, arsenic, cyanide, and other poisons were produced on a daily basis. Across town at Catholic University, a team of scientists headed by Winford Lee Lewis developed a novel blister agent, "lewisite." A dark, oily liquid containing 36 percent arsenic, lewisite irritates the eyes, skin, and lungs and can be lethal when inhaled in high concentrations. At the American University Experiment Station, chemists worked in secrecy to perfect a production process for the new agent.

In 1918, the Chemical Warfare Service was transferred from the Bureau of Mines to the War Department, which leased additional farmland northwest of American University to field-test the chemicals and munitions developed at the experiment station. Known as Camp AU, the proving grounds were surrounded by high walls covered with razor wire, with only one entry gate in the 3-mile perimeter. [2] The test site included a static fire area and a chemical persistency area 500 feet in diameter that was repeatedly covered with mustard agent.

Scientists at Camp AU simulated the battlefield at Verdun, France, by digging two pairs of circular trenches, one inside the other, with the outer ring 200 feet in diameter. These circular trenches were rigged with wires to detonate experimental shells, bombs, and mortar rounds filled with mustard, lewisite, cyanogen chloride, adamsite, phosgene, and other toxic agents. [3] Soldiers staked goats and dogs in the trenches, detonated the munitions remotely, and recorded their effects on the animals. Little attention was paid to public safety--chemical bombs exploded as trolley cars went past on Massachusetts Avenue. [4]

After World War I ended in November 1918, the chemical warfare effort at American University wound down. The War Department burned the temporary buildings and filled in the trenches and pits. An army memo issued in March 1919 directed the chemical weapons research division to ship all unused munitions to Edgewood Arsenal in Maryland. Even so, an unknown number of chemical munitions and jugs of warfare agents were buried on site before the land was returned to its original owners. [5]

During World War I, soldiers had dubbed the chemical weapons test site "Death Valley." But during the 1920s, when residential development began, the area acquired a new and more appealing name, Spring Valley.

Emergency cleanup

In 1986, federal analysts at the Environmental Protection Agency's Environmental Photographic Interpretation Center analyzed aerial photo-graphs of the Spring Valley area taken in 1918, 1927, 1937, and 1982. These photos showed the locations of the 1918 trenches, buildings, and bomb pits before and after the area was subdivided into residential developments. Analysts pored over the historical images looking for "ground scars"--light areas where the earth had been disturbed or where nothing grew--which would offer clues to the locations of undiscovered trenches and chemical weapons burial sites.

In July 1986, the EPA center submitted a report to the army pointing out the location of two possible burial pits on the former proving grounds and other suspect areas on the American University campus. Army officials concluded that although the existence of small quantities of buried laboratory materials could not be ruled out, the evidence was not sufficient to warrant further action. Accordingly, the army shelved the EPA report without sharing it with city officials, residents, or the development company building homes in Spring Valley. [6] The Army Toxics and Hazardous Materials Agency subsequently prepared a report for American University stating that Spring Valley was safe because the 1919 memo had ordered the transfer of chemical weapons to Edgewood after World War I, and no munitions had been unearthed since then despite extensive farming and development. [7]

Then came the January 1993 discovery of the cache of buried chemical weapons at the

construction site. Workers from the army's Chemical and Biological Defense Command, wearing gas masks and protective clothing, evacuated homes in stages around the bomb pit while soldiers sifted through dirt piles for old munitions. "Operation Safe Removal," which lasted for the next two years, recovered and removed 141 munitions, 43 of which contained chemical warfare agents.

During the second phase of this operation, the U.S. Army Corps of Engineers made a comprehensive survey of the neighborhood to determine if other sites still harbored unexploded ordnance and chemical contamination. In June 1995, the Corps issued a report concluding that Spring Valley was now safe, and the EPA concurred that no further action was necessary. According to critics, the two agencies declined to pursue more aggressive steps for cost reasons. [8] But some local residents were also happy to see the army investigation end, fearing that reminders of the neighborhood's toxic past would depress property values.

The telltale photo

Over the next few years, however, various types of historical documentation, including the aerial photos, suggested that the Army Corps had failed to search several areas of Spring Valley for pits where canisters of mustard, lewisite, and other poisonous agents might still be buried. Erik Olson, a senior attorney in the Washington, D.C., office of the Natural Resources Defense Council, found another key piece of evidence. After reading in the newspaper about the discovery of World War I chemical munitions in Spring Valley, he recalled hearing that his maternal grandfather, Sgt. C. W. Maurer, had buried chemical weapons when he was stationed at Camp AU in 1918.

Olson called his mother, who found a trunk containing her father's memorabilia. Inside were more than a dozen well-preserved photographs, one of which showed a soldier wearing a gas mask leaning over a row of about 20 5-gallon jugs. On the back of the photo (above), Sergeant Maurer had written: "The Pit, the most feared and respected place on the grounds. The bottles are full of mustard, to be destroyed here. In Death Valley. The hole called Hades." Olson gave a copy of the photo to the Army Corps of Engineers, but the location of the burial pit shown in the image was never determined.

In 1996, officials at the District of Columbia Department of Health expressed concern about the army's investigation, noting that the aerial images and Sergeant Maurer's photograph suggested that Spring Valley contained additional burial sites. The Army Corps of Engineers rejected most of the city's arguments, but finally admitted in September 1997 that it had looked in the wrong place for the mustard burial pit. Although the 1927 aerial photograph had shown a ground scar in the vicinity of Glenbrook Road, the Corps' 1993--1995 investigation had found no evidence of a disposal pit in the area. On reviewing the evidence, army engineers realized that because of a mapping error, they had missed the suspected pit by about 150 feet. The newly identified site was just across the American University property line, in the backyard of South Korean Amb. Hong-Koo Lee's residence, an expanse of green lawn and ornamental gardens.

The army reluctantly agreed to conduct a follow-up inquiry, in coordination with the EPA and the D.C. Department of Health.

In February 1998, the Corps conducted a geophysical survey of the South Korean ambassador's backyard and concluded that two chemical weapons disposal pits might exist there. Excavations, which began in February 1999 and lasted until March of the following year, turned up mortar shells, smoke bombs, bottles of chemicals, metal drums, scrap, wooden training aids, pieces of ceramic, and other debris. The soil contained extremely high levels of arsenic--more than 1,000 parts per million, compared to the normal background level of 13. [9] A cleanup of the South Korean ambassador's backyard included the removal of 150 barrels of contaminated soil.

Elevated levels of arsenic were also found at several other locations in Spring Valley, including the Child Development Center at American University, which had a soil arsenic concentration averaging 60 parts per million, with a high of 498. Exposure to high levels of arsenic is known to cause cancer and other chronic diseases.

The health concerns of Spring Valley residents were heightened by reports of several cases of unusual illnesses on Sedgwick Street, where houses had been built over one of the trenches where chemical weapons were tested in 1918. Two residents of the street had died of multiple myeloma, a bone-marrow cancer that strikes about five people per 100,000. In addition, the December 2000 issue of *Washingtonian Magazine* reported two cases of aplastic anemia over the past 30 years in adjacent houses on Sedgwick Street. (A rare disease involving an unexplained failure of the bone marrow to produce blood cells, aplastic anemia affects one person in 400,000 and has been linked to exposure to environmental toxins, including arsenic.) A fifth case of serious illness, pernicious anemia, had been diagnosed earlier in a 19-year-old woman who was then living on Sedgwick Street. [10]

These disturbing findings raised concerns among city officials that the buried chemical weapons might pose serious environmental and health risks. In response, the Corps agreed to speed up soil testing at homes on Sedgwick Street in the vicinity of the former testing trench.

Meanwhile, after two years of digging up the South Korean ambassador's backyard in search of the buried jugs of mustard agent, the Army Corps concluded that the actual burial site was next door, in an unoccupied property on Glenbrook Road. (The former owners had exercised a buy-back clause with the developer after high levels of arsenic had been found in the soil.)

Workers in full protective gear excavated the yard, placing a filter tent over the pit to prevent any contaminated dust from escaping. On July 5, 2001, army officials announced that they had found two bottles containing mustard and five bottles containing lewisite at a depth of about eight feet, as well as six 75-millimeter mortar rounds. [11]

The Corps is currently engaged in a major survey of the entire Spring Valley neighborhood, sampling soil from all 1,200 residential and 400 non-residential properties. This effort is expected to take eight months and cost as much as \$3.5 million. The federal government has already spent \$50 million to clean up contaminated areas in Spring Valley and has earmarked another \$35 million for this purpose over the next two years. [12] In addition, the disclosure that the army suppressed the 1986 EPA report indicating the possible presence of buried chemical weapons has sparked an angry response from the community and prompted the FBI, the EPA's criminal division, the Justice Department, and military investigators to look into the case.

The non-stockpile problem

Spring Valley is one of dozens of locations in the United States where long-buried chemical weapons pose a continuing environmental and health threat. Blister agents such as mustard and lewisite are highly persistent and can remain dangerous for decades. Even after lewisite breaks down, the resulting arsenic compounds can remain in soil and contaminate ground water. Many buried chemical munitions also retain their explosive components, which decompose to form toxic substances.

Until the late 1950s, the disposal of chemical weapons by burial and sea-dumping was an accepted and approved practice. Millions of bombs, shells, mortar rounds, mines, and rockets containing toxic agents were buried, dumped at sea, or simply abandoned by retreating armies. Since disposal by burial was supposed to be final, many of the locations were not recorded. Even when buried chemical munitions can be found and recovered, handling and disposal are difficult because the weapons have often deteriorated and the identity and condition of the chemical fill may not be known.

The Chemical Weapons Convention (CWC), which entered into force in April 1997, requires each member-state to destroy all military stockpiles of chemical weapons, but it imposes no obligation to retrieve and destroy chemical munitions that were buried on a member's territory before January 1, 1977, as long as they remain buried. The same applies to chemical weapons that were dumped at sea before January 1, 1985. If, however, buried chemical weapons are exposed by digging or erosion, or sea-dumped weapons are brought up in fishing nets, they must be declared to the treaty organization in The Hague and disposed of separately from weapons in the regular stockpile. In addition, the CWC stipulates that any member-country that has abandoned chemical weapons on the territory of another member is responsible for their removal and destruction.

In 1992, Congress ordered the U.S. Army to recover and destroy all buried chemical weapons on American territory, a task that could take as long as 30 years and cost several billion dollars. The army's Non-Stockpile Chemical Materiel Program, based at Aberdeen Proving Ground in Maryland, coordinates the destruction of buried chemical weapons, former production facilities, binary chemical weapons, and unfilled munitions. Although the army developed a comprehensive plan in 1995 to deal with non-stockpile matériel in the United States, the problem has received little attention compared with the regular stockpile. [13]

Identifying potential chemical weapon burial sites involves an extensive review of historical documents, interviews with people who may have relevant information, and soil sampling. Currently, army officials estimate that the United States has 101 known or suspected chemical weapon burial sites in 38 states, the District of Columbia, and two territories (Guam and the U.S. Virgin Islands). Of the 101 identified locations where buried chemical agents or munitions are known or suspected, the army has determined that no hazard exists at 33. Of the remaining 68 locations, 43 are located on current Defense Department installations and 25 are "Formerly Used Defense Sites" that are no longer under the jurisdiction of the federal government. [14]

Most of the burial sites involve small quantities of toxic agents in vials, bottles, metal containers, artillery projectiles, mortar cartridges, bombs, and Chemical Agent Identification Sets, which

contain vials of mustard and lewisite that were used for training purposes. The United States also buried or dumped chemical weapons in other countries after World War II, although the locations remain classified.

At U.S. military bases with buried chemical weapons, it is the responsibility of each base to conduct recovery and cleanup operations, and public pressure may be required to force base commanders to take action. At formerly used sites, the Army Corps of Engineers is legally responsible for recovery and cleanup. The Corps is currently prioritizing these burial sites; its plan is to destroy the recovered weapons on site in mobile facilities that use chemical reactions to convert warfare agents to less toxic substances, after which the neutralized material will be placed in hazardous waste landfills. Funding for these operations is available from the Defense Environmental Restoration Account, but whether a given dump site will be cleaned up is at the discretion of the local district or division of the Corps.

A global threat

The vast numbers of chemical weapons buried on land or dumped at sea pose a global environmental and health threat whose dimensions are still poorly understood. Germany's Bonn International Center for Conversion has estimated that more than 1 million tons of chemical weapons were dumped into various bodies of water between 1945 and 1970. The United States alone dumped about 100,000 tons of chemical weapons--the equivalent of 39 railroad boxcars--into the Gulf of Mexico, off the coasts of New Jersey, California, Florida, and South Carolina, and near Australia, Denmark, India, Italy, Japan, and Norway.

The situation in Russia is perhaps most acute. Moscow inherited from the former Soviet Union a declared chemical weapon stockpile consisting of approximately 40,000 metric tons of nerve and blister agents. [See "Chemical Weapons Disposal: Russia Tries Again," on the next page.]

But Lev Federov, a Russian activist and president of the Union for Chemical Safety, contends that Soviet authorities dumped roughly 500,000 tons of chemical weapons (including both Soviet-made munitions and those captured from Nazi Germany) between the end of World War II and the late 1980s. Many of these weapons were sunk in the Baltic Sea, the Kara Sea, and the Sea of Japan; roughly half contain mustard agent and the rest are filled with 13 other types of chemical agents, including sarin nerve agent. Federov also claims that tens of thousands of tons of chemical munitions lie buried in unmarked pits in Russia that military leaders refuse to acknowledge or take responsibility for cleaning up. [15] This toxic legacy is a potential time bomb, with frightening implications for the health of the Russian population. At the same time, the cost of cleanup would impose an intolerable financial burden on a country that is already struggling economically.

The situation with sea-dumped chemical weapons is equally grave. Because mustard agent congeals in salt water and can remain toxic for decades, fishermen in the Baltic Sea and in the waters off Japan have recovered hundreds of leaking mustard shells in their nets, resulting in serious burns. Although commercial fishing was outlawed in the worst-affected parts of the Baltic in the early 1990s, some fishing reportedly continues despite the ban. According to Russian scientists, chemical munitions dumped in the Baltic five decades ago have corroded to the point that they have begun to leak, and samples from the seabed show the presence of toxic agents. Environmentalists fear that huge numbers of corroding shells could release large bursts of poisonous chemicals into the sea, affecting commercial fish harvests and entering the food chain, with potentially catastrophic consequences for oceanic life and human health. [16]

Buried and sea-dumped chemical weapons pose serious risks to the international environment. Because the costs of recovery, destruction, and remediation exceed the resources of any one country, a global strategy will be needed to address this toxic legacy of war. With the political support of the Security Council, the U.N. Environment Program, the World Health Organization, and other U.N. agencies should join together to develop an international action plan to address this pressing problem. Although the discovery of buried chemical weapons in Spring Valley has been disastrous for those directly affected, it could have the salutary effect of getting Washington policy-makers to pay attention to a serious issue that has been too long "out of sight, out of mind."

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