

# ANTHRAX

## ASSESSING THE RISK

**Availability** HIGH. The anthrax bacterium grows naturally throughout the world, including the United States. There are about two thousand labs in the United States alone that have anthrax samples, not to mention hostile foreign nations such as Iraq that have large supplies. However, obtaining a strain that would do the greatest harm would not be simple.

**Stability** HIGH. Anthrax spores are highly resistant to drying and to extremes of heat and cold. The spores also are resistant to some disinfectants. Spores can survive in the environment for decades.

**Deliverability** MEDIUM. It takes technical skill to refine anthrax to the extremely tiny size required to get into the lungs, the staging ground from which it launches its often deadly attack on the body. But as we've learned, someone with that skill can send anthrax through the mail with deadly consequences. Considerably more sophistication would be required to manufacture anthrax for an aerosol release that could inflict mass casualties.

**Lethality** HIGH. It was thought before the postal attacks that inhalational anthrax would be fatal in 80 to 95 percent of cases. However, six of the eleven people who contracted the disease last fall survived thanks to fast treatment with antibiotics.

Although most Americans knew little about anthrax until recently, the disease has been around at least since biblical times.

Many believe that anthrax fits the description of the fifth “grievous” plague that killed the Egyptians’ livestock after

Pharaoh refused to free the Israelites, as recounted in the book of Exodus. Descriptions of similar plagues can be found in the writings of Homer, Virgil, and the ancient Hindus.

But it was the use of the mail to send lethal, anthrax-laced letters to media outlets and government offices last fall that suddenly made this ancient disease a household word. Even now, months after the postal attacks that infected eighteen and killed five, there are a lot of misconceptions about anthrax. For instance, a poll conducted more than a month after the attacks found that a quarter of Americans believed the disease is contagious. It's not. But it's no wonder people are confused. Much of what we know about anthrax as a biological weapon was learned during the attacks last fall.

### **WHAT IS ANTHRAX?**

Anthrax is an infectious disease that can affect both animals and humans. The illness is caused by a spore-forming bacterium called *Bacillus anthracis*. Three forms of anthrax can occur: skin (or in medical terms, cutaneous), inhalational, and gastrointestinal. The form varies based on how the anthrax bacteria enter the body.

The bacterium gets its name from the Greek word for coal, *anthrakis*, because the skin form of the disease—which is by far the most common in humans—is characterized by skin sores that turn coal-black.

*Bacillus anthracis* can switch back and forth between two states: the active “vegetative” form, and the dormant “spore” form that you’ve heard so much about. The bacterium is only technically alive when it is in the vegetative state. That’s when it can reproduce, take in nutrients, and get rid of wastes. When the bacterium senses a lack of nutrients or water, it dries out and encases itself in a thick, hard shell called a spore that protects it against extreme heat, cold, and even some types of radiation (but not the gamma

irradiation currently being used to treat the mail).

In this state of suspended animation, the spores can survive in the soil for decades. That's why anthrax primarily strikes grass-eating animals, such as cattle, goats, sheep, and horses. In fact, viable anthrax spores can still be found along the cattle trails of the Old West.

### **WHERE IS ANTHRAX FOUND?**

Anthrax is not uncommon in agricultural areas of the world, such as Africa and the Middle East. An estimated 20,000 to 100,000 human cases occur globally each year, most of which are skin infections. However, anthrax is rare in industrialized nations such as the United States.

Between 1944 and 1994, just 224 cases of the skin form of the disease were reported in the United States. In the last century, only 18 cases of inhalational anthrax—the most deadly form of the disease—were reported in this country. Two of those cases were related to laboratory work, and not a single inhalational case was reported in the twenty-five years leading up to September 11, 2001.

For thousands of years, the threat of anthrax to humans was primarily limited to farmworkers, woolsorters, and, in rare cases, those who ate tainted meat. That all changed with the postal attacks that followed in the wake of the September 11 terrorist attacks. As of January 1, 2002, 18 newly confirmed cases of anthrax had been identified in the eastern United States and 5 people had died of the disease. This recent outbreak makes it abundantly clear that anthrax can be used as a bioterrorist weapon against civilian populations.

### **HOW IS ANTHRAX SPREAD?**

It's important to note that anthrax is *not* a contagious disease. That means it can't be passed from one person to another. The only way

to be infected is to come into direct contact with anthrax spores through one of the ways outlined below.

Humans can contract anthrax several different ways: by directly handling infected animals or contaminated animal products (such as wool or hides); by inhaling anthrax spores into the lungs; and by eating undercooked meat from infected animals. The recent cases from tainted mail demonstrate that infection can also be acquired by handling artificially contaminated items, such as letters or packages.

Handling contaminated animals, animal products, or artificially contaminated items can lead to skin infections. Anthrax spores enter the skin through minor cuts or scrapes; the most frequently infected areas of the body are the arms, hands, face, and neck—the areas most often left exposed. The average time from exposure to onset of illness (the incubation period) for skin infection is one to seven days. Cutaneous anthrax accounts for an overwhelming majority (an estimated 95 percent) of all anthrax cases.

Inhaling the spores can lead to inhalational anthrax. This is the form that concerns us most, because it is the form most likely to be used as a biological weapon and it is the most deadly. Experts believe that the average lethal dose for inhalational anthrax is ten thousand spores, although in view of the recent postal attacks, we now believe that a smaller number can be fatal, especially for the elderly and those with a weakened immune system.

Once inhaled, the microscopically tiny spores—each one less than one-twentieth the diameter of a human hair—lodge in the lungs and then spread to lymph nodes in the middle of the chest between the lungs, in what is known as the mediastinum. The spores convert back to their active vegetative state and begin multiplying with a vengeance.

In hours, or perhaps a few days, a deadly toxin is released that spills over into the bloodstream. Severe shock and death frequent-

ly follow. Antibiotics are most successful if begun before the toxins are released.

In the inhalational anthrax cases following September 11, the average time from exposure to the bacteria to the onset of symptoms was four days. But experts believe that illness may occur as long as sixty days after exposure to anthrax spores, because observations have shown that the spores can take that long to change to active bacteria. That explains why preventive (prophylactic) antibiotics are typically given for a sixty-day period. Nonhuman primate studies have suggested that illness may occur up to a hundred days after exposure. This is why after very high exposure to spores, an additional forty days of preventive antibiotics may be recommended.

The third, and least common, way to get anthrax disease is by eating contaminated meat from infected animals. This type of exposure leads to gastrointestinal anthrax, which usually has an incubation period of two to five days.

## **WHAT ARE THE SYMPTOMS OF ANTHRAX?**

Symptoms of anthrax depend on how the disease is contracted. Here's what to look for in each case.

### ***Skin (Cutaneous) Anthrax***

Cutaneous anthrax begins as an itchy bump that resembles an insect bite. Within a day or two, it grows into a round, fluid-filled ulcer about a half-inch to a little more than an inch in diameter. A depressed, painless black scab—the characteristic feature of the disease—then forms in the middle of the ulcer. The scab loosens and falls off within one to two weeks, leaving only minimal scarring, if any. Severe swelling may occur around the ulcer and

painful swollen lymph nodes may develop in the area. If left untreated, an estimated 20 percent of people will die from cutaneous anthrax. However, with proper antibiotic treatment, the odds of survival are extremely high.

### ***Inhalational Anthrax***

The most deadly form of the disease progresses in two distinct stages. The first phase resembles a flulike illness and is marked by fever, chills, headache, nausea, vomiting, muscle aches, and fatigue. Within hours to a few days, during which some patients experience what appears to be a brief period of recovery, the disease moves into its more deadly second stage. This is characterized by high fever, fluid in the lungs, severe breathing problems, and low blood pressure. Massive swelling of lymph nodes in the chest may occur. About half of those with the inhalational form of the disease develop anthrax meningitis if untreated. Left untreated, up to 90 percent of patients may die. However, with early treatment using appropriate antibiotics, the risk of death may be much lower (30 percent). Exciting research on new antitoxin therapy will likely reduce this risk much further in the future.

### ***Gastrointestinal Anthrax***

Gastrointestinal anthrax can cause two distinct types of illness. The more common form affects the small or large intestine and resembles a severe case of food poisoning. Initial symptoms include nausea, loss of appetite, vomiting, and fever. These symptoms are quickly followed by abdominal pain, vomiting of blood, and severe diarrhea. A less common form of gastrointestinal anthrax causes a severe sore throat, fever, trouble swallowing, and, sometimes, ulcers in the mouth or back of the throat. Very tender swollen lymph nodes may occur in the neck. If gastrointestinal anthrax is left untreated, about 50 percent of patients will die from the infection.

**WHAT DOES IT MEAN WHEN ANTHRAX IS “AEROSOLIZED”?**

That simply means it has been made airborne. Anthrax spores naturally tend to clump together in chunks so big that your body’s natural mechanical defense system would intercept them before they got deep into the lungs where they cause the biggest problems.

So someone would not only have to be able to refine the particles to microscopically small sizes—an estimated one to five microns in width — but also have enough knowledge to use chemicals to break up the clumps. During this very difficult process, the bacteria can often be rendered inactive.

**WHAT DOES IT MEAN WHEN ANTHRAX IS “WEAPONIZED”?**

Aerosolizing anthrax is one type of “weaponization,” a word that refers to engineering the anthrax spores, either physically or genetically, so they are delivered more efficiently and are more deadly. In the cases following September 11, there was evidence that the anthrax spores had been specially treated so they would remain suspended in the air for prolonged periods, making them more likely to be inhaled because they could literally float out of an envelope.

Another type of weaponization of anthrax, perfected by the Russians in the 1970s, is to engineer it to make it resistant to antibiotics. This fortunately was not the case with the anthrax sent last fall. Given antibiotics’ effectiveness against anthrax when used early enough, this is the largest bioterror concern. Other types of weaponization include special milling to refine particle size, adding agents such as stabilizers or skin irritants, and genetic modification to alter the incubation period.

Most experts believe that only a person, a group, or a country with access to advanced biotechnology would be capable of manufacturing and delivering a lethal anthrax aerosol. For example, the

Japanese terrorist group Aum Shinrikyo, which was responsible for the release of deadly Sarin gas in the Tokyo subway system in 1995, had previously tried to disperse aerosolized anthrax and botulism throughout Tokyo on several occasions. For reasons that remain unclear, the attacks caused no illnesses.

### **CAN ANTHRAX REALLY BE USED AS A WEAPON OF MASS DESTRUCTION?**

The answer is yes, though to date it has not been.

Fortunately, it's far more difficult to convert anthrax into a weapon of mass destruction than you may have been led to believe. First, only certain strains of anthrax bacteria are exceptionally deadly. A bioterrorist would have to have access to a particularly virulent strain and then brew a large batch of the microbes. The bacteria would have to be dried and converted to spores, then refined into very, very small particles.

The recent distribution of anthrax through the mail system infected at least eighteen people and killed five. The mail system was paralyzed regionally, Congress was essentially shut down for four days, buildings were closed for months. The country was terrorized. But anthrax was not used, as it might have been, as a true weapon of mass destruction. The same amount of anthrax placed in the ventilation system of a building could have exposed thousands to a lethal dose.

For more than three decades, scientific, military, and health experts have tried to analyze the consequences of a large-scale anthrax attack. The worst-case scenario would be that some nation or group was able to spread anthrax from an airplane over a major metropolitan area. In an analysis that is over thirty years old and conducted long before we developed the National Pharmaceutical Stockpile and early-mobilization program, the World

### ANTHRAX AS A BIOWEAPON A Brief History

Research on anthrax as a biological weapon dates back to World War I, when the Germans tried to use it to disrupt the Allies' horse- and reindeer-drawn supply lines across northern Norway. Eighty years later, scientists discovered that a lump of sugar laced with anthrax by a German spy still contained living spores.

During World War II, the United States, fearful that Japan and Germany were making bioweapons, first began experimenting with anthrax and other germ warfare. It was later discovered that Japanese scientists subjected Chinese prisoners of war to horrifying experiments with such lethal bioagents as anthrax, cholera, typhoid, and plague. As many as ten thousand were killed.

The British also conducted anthrax experiments during World War II, detonating explosive shells filled with anthrax spores on an island off the coast of Scotland. The spores were still viable thirty-six years later, and it took an intensive, eight-year decontamination effort requiring 280 tons of formaldehyde and 2,000 tons of seawater to clean up the island.

During the Cold War, the United States and the Soviet Union both undertook extensive bioweapons campaigns that included anthrax. But in 1969, President Richard M. Nixon ended the U.S. offensive biological warfare program and ordered all stockpiled weapons destroyed. In 1972, the United States and more than a hundred nations—including the Soviet Union, Iraq, and Iran—signed the Biological and Toxin Weapons Convention, banning bioweapons.

The Soviets, however, ignored the treaty and geared up their offensive, attack-oriented program. Over seven thousand scientists were involved in this effort. In 1979, anthrax spores were accidentally released into the atmosphere from a secret Soviet military facility in Sverdlovsk. At least seventy-seven people downwind were infected, and sixty-six died.

In the mid-1980s, Iraq launched a bioweapons program and had managed to develop weaponized anthrax by the time of the Gulf War. Iraq reportedly even tested crop-dusting equipment to spread anthrax over a wide area but could not get it to work.

Health Organization estimated in 1970 that the release of aerosolized anthrax over a densely populated area with 5 million people could result in 250,000 casualties, 100,000 of whom would die unless treated.

In another analysis, the U.S. congressional Office of Technology

Assessment (OTA) estimated in 1993 that releasing aerosolized anthrax over Washington, D.C., could result in 130,000 to 3 million deaths—an attack as deadly as a hydrogen bomb. In addition to the horrifying human toll, the economic impact would also be devastating. The Centers for Disease Control and Prevention (CDC) has estimated it would cost the U.S. economy \$26.2 billion for every 100,000 people exposed to anthrax.

But, remember, most of these modeling exercises involve assumptions that might not be applicable today. For example, the OTA assessment assumed the attack would not be recognized for six days.

As you'll recall, the government grounded crop dusters for several days in the wake of the September 11 attacks after it was determined that the terrorists had asked questions of a Florida operator. We know that Iraq tested crop-dusting equipment to spray anthrax before the Persian Gulf War, but the effort was unsuccessful. Major modifications would be required to retrofit a plane's sprayer nozzles to spread anthrax in the extremely small, dry particles that would do the most harm.

Again, it would require considerable technical expertise to do this. Dosage and dispersal would be affected by atmospheric conditions, wind, terrain, sun, and other environmental factors. Nevertheless, the impact in terms of terror would be huge.

### **HOW DO I TELL THE DIFFERENCE BETWEEN THE FLU AND INHALATIONAL ANTHRAX?**

The initial stage of inhalational anthrax does resemble the flu (or influenza-like illnesses), but remember, in the winter months, the flu, like the common cold, is a common illness, whereas anthrax is rare and will occur only if you are exposed to the spores. Assume you have the flu unless:

- Anthrax exposure or cases are reported in your community.

- You have reason to believe you have been exposed to anthrax through a suspicious letter or package.
- People around you are suddenly and for no apparent reason coming down with what seems to be the flu or suspicious skin sores. But remember, a cluster of flulike cases is still probably the flu.

Your doctor can give you a quick test for influenza, if you're concerned, though it is not anywhere near 100 percent accurate. That said, there are some subtle differences between anthrax and the flu. Nasal and sinus congestion, sore throat, headache, and a runny nose are common with the flu and the common cold, but not with anthrax. Chest discomfort, vomiting, and shortness of breath are usually associated with anthrax, but not with the flu.

A chest X ray may also be helpful in distinguishing the two. Each of the ten initial patients confirmed to have inhalational anthrax as a result of the recent postal attacks had X-ray abnormalities such as widening of the mediastinum (lymph nodes between the lungs) and fluid around the lungs. You don't typically see these findings with the flu.

It is wise to get a flu shot each year to minimize your chances of catching the flu, and thus lessening the opportunity to even have to think about whether your symptoms might be related to anthrax.

## **HOW IS ANTHRAX TREATED?**

Antibiotics can be quite successful in treating patients who are ill with anthrax. People who have cutaneous anthrax or gastrointestinal anthrax usually can be treated without problems. For antibiotics to be effective in treating inhalational anthrax, it's best if they are given early in the course of illness. Also, the CDC recommends

that at least two different antibiotics be used to treat inhalational anthrax.

Antibiotics also can be used to prevent illness after inhalational exposure to anthrax spores. You've probably heard a lot about Cipro (ciprofloxacin) being the top antibiotic choice for preventing anthrax. But doxycycline is equally effective, if the strain of anthrax bacteria involved is not resistant to it.

In fact, as the number of people initially taking ciprofloxacin during the recent postal-related outbreak neared thirty thousand, the CDC switched its preferred recommendation to doxycycline. The change was made in part because of concern that other bacteria would develop resistance to ciprofloxacin with so many people using it.

Doxycycline—which is available in generic form and is about one-tenth the cost of Cipro—was a good alternative under those circumstances. Although recommendations may be modified over the coming months, currently, when no information is available about whether the implicated strain of anthrax bacteria is especially susceptible to any particular antibiotic, ciprofloxacin or doxycycline is recommended for adults and children, although the course for children varies slightly.

Provided the particular strain of anthrax isn't resistant to it, penicillin is recommended by the CDC as another option for the sixty-day course of antibiotics after exposure. However, it is not considered as effective as Cipro or doxycycline for treatment of the disease.

The CDC recommends that preventive treatment with antibiotics continue for sixty days, since it has been shown that the incubation period can be that long. Side effects of treatment with Cipro seen after the anthrax exposure last fall included joint aches and gastrointestinal discomfort in adults. Approximately nine thousand people in Florida, Washington, D.C., New York, and New Jersey were advised to take antibiotics for the full sixty days.

Assessment of side effects and how many people continued the entire sixty-day regimen is under way. And public health experts continue to evaluate how to deal most effectively with anthrax. It may be that, for those individuals with high exposure to airborne anthrax spores, the antibiotic regimen should be extended an additional forty days, just to be on the safe side. And for those at greatest risk of inhalational anthrax, such as those in the room when an anthrax-laden letter is opened, the option of vaccination in addition to antibiotics should be considered.

In response to the events in the Hart Senate Office Building, the CDC in late December of 2001 elected to make anthrax immunization available to the seventy individuals in the immediate vicinity of where the letter was opened.

Currently, the Food and Drug Administration (FDA) has indicated that ciprofloxacin, penicillin G procaine, and doxycycline are approved for preventive treatment following inhalational exposure to anthrax spores. In addition, tetracycline, minocycline, oxytetracycline, demeclocycline, and penicillin G potassium are approved by the FDA for treatment of patients who are clinically ill with anthrax infection.

Every emergency room has plenty of antibiotics on hand for those who need them. Currently, the National Pharmaceutical Stockpile has enough antibiotics to fully treat two million people after an anthrax exposure, and recent federal funding will soon increase that number to millions more. These “push packs” of antibiotics can be made available anywhere in the country within twelve hours.

### **WHAT ABOUT CHILDREN? IS THERE ANY DIFFERENCE IN THEIR TREATMENT?**

For children, the CDC says Cipro and doxycycline can be used for the first two to three weeks of treatment to prevent inhalational

anthrax, and for the first one to seven days of treatment for cutaneous anthrax.

The rest of the sixty-day course can be completed with amoxicillin, a form of penicillin that is known for its safety with children and infants, if the organism is sensitive to it. This strategy could avoid potential side effects in children.

The American Academy of Pediatrics generally recommends that doxycycline not be used in children under nine years old because the drug may retard skeletal growth in infants and cause discolored teeth in infants and children. Cipro is not generally recommended for children under the age of sixteen because it may cause temporary joint disease in a small number of children.

However, those potential side effects are greatly outweighed by the serious risk anthrax poses.

### **WHAT ARE THE SIDE EFFECTS OF CIPRO FOR ADULTS?**

Cipro is generally well tolerated. Side effects include vomiting, diarrhea, sun sensitivity, rash, headaches, and dizziness. With prolonged courses of antibiotics, joint aches have been reported. Blurred vision, hypertension, and other nervous system symptoms occur in fewer than 1 percent of patients. Caffeine and medications containing theophylline may accentuate the symptoms.

Each antibiotic has different side effects. Whenever you're prescribed an antibiotic, take time to talk to your physician about the side effects of the specific medicine you are given.

### **IS THERE A TEST TO SEE IF I'VE BEEN EXPOSED TO ANTHRAX?**

Simply put, there is no screening test that determines exposure to anthrax.

We must distinguish between exposure and infection. Exposure is determined by environmental tests; potential exposure is treated with preventive antibiotics. Exposure is not infection. Infection means you have the clinical disease and you need aggressive treatment with antibiotics.

In the opening chapter, I talked about the more than six thousand nasal swab tests that were done on those who were potentially exposed to anthrax spores on Capitol Hill. These tests are best thought of as environmental tests, because all they do is tell where spores have been. They do not detect the presence or absence of *disease* in an individual. They are not like the more familiar throat-culture swabs taken for suspected strep throat, which *are* useful for making treatment decisions for an individual because they detect whether or not that person has a disease.

Nasal swabs are typically used to determine how far spores have traveled in a specific room or building where the presence of anthrax is suspected or has already been established by environmental sampling. They are useful only for public health officials to define the perimeter of potential exposure. At the current time, recommendations for preventive antibiotics are made on the basis of probable exposure.

So no one should request a nasal swab thinking it will change his or her personal care.

To determine actual infection or disease (not just exposure), there is a blood culture test that's accurate and definitive. It involves placing a blood sample in a culture of nutrients and then waiting twenty-four to seventy-two hours to see if an anthrax colony grows. The lack of a fast, accurate, simple test to determine infection is one of the challenges we face. Promising new technology is on the horizon, however.

Scientists are developing a test that would use DNA technology similar to that used in criminal investigations and genetic tests to deliver accurate results within just two to three hours. And there is

some indication that radio imaging used to detect infections may be able to be adapted so it picks up signs of anthrax infections before they spread to the bloodstream. Best of all, the test would take only forty-five minutes. As noted earlier, early diagnosis and treatment—ideally before onset of symptoms—may play an important role in saving the lives of those who contract inhalational anthrax.

### **SHOULD I TAKE ANTIBIOTICS “JUST IN CASE”?**

The short answer is no. To begin with, the antibiotics used to treat anthrax carry serious side effects for some people. There’s no reason to subject yourself to them unless there is a real risk of disease.

Even more important, if you take antibiotics when you don’t actually need them, there’s a chance they won’t work if and when you do. Bacteria are cagey, versatile, and always changing. When exposed to antibiotics for prolonged periods, the bacteria self-select and become resistant to that antibiotic and even to related antibiotics. That creates a very real potential danger for you and for others because there may be no treatment for future disease caused by that self-selected, resistant bacteria.

### **SHOULD I STOCKPILE A SIXTY-DAY SUPPLY OF CIPRO OR DOXYCYCLINE?**

It’s not a good idea to stockpile antibiotics. They have a specific shelf life, and it’s possible the antibiotics would expire before you needed them. Plus, if many people hoard the antibiotics, it creates the possibility that there could be a shortage if they actually were needed somewhere.

Many would be tempted to take the drugs unnecessarily, opening up the potential for side effects and the Pandora’s box of poten-

tially resistant, deadly bacteria—not only for themselves, but for society as a whole.

### **SHOULD I BE VACCINATED FOR ANTHRAX?**

There is an anthrax vaccine, which, according to the CDC, is recommended for people aged eighteen years and older who have a high likelihood of coming into contact with anthrax spores. These include military personnel; certain laboratory workers; people whose jobs may expose them to anthrax, such as those who work with animal products from areas of the world where disease in animals is common; and veterinarians who may handle potentially infected animals (again, in areas of the world where anthrax is common).

In addition, last December for the first time, the vaccine was offered to those who had high direct exposure to the anthrax in our mail system.

The vaccine is in extremely short supply, and it is not available to the general public. Currently, only one small company in Michigan is licensed to produce the vaccine. But a large-scale vaccination program really isn't called for, considering the enormous cost and difficult logistics, coupled with the low probability of an attack in any given community. Remember, even with the postal attacks last fall, the odds of any one person contracting anthrax are much less than those of getting struck by lightning or attacked by a shark.

Also, the current vaccine is given in a series of six shots over eighteen months, and a yearly booster shot is also recommended. It is known to protect against skin infection and is believed to be effective against inhaled spores as well. About a third of those who get the vaccine experience tenderness and redness in the area of the shot. More severe reactions are infrequent.

Promising new vaccines are being developed, and one of our

top priorities in safeguarding our nation against possible anthrax attacks is to develop, manufacture, and stockpile a new generation of vaccine. Last December, the CDC acquired 220,000 doses from the Pentagon to investigate how best to use the current vaccine in the meantime. Vaccinating all the people considered potentially at risk today for occupational reasons would require at least 28,000 doses.

### **SHOULD I BE AFRAID TO OPEN MY MAIL?**

Until as recently as October 2001, experts believed that there was little threat posed by letters coming in contact with anthrax-laced mail or going through postal machinery that handled contaminated letters. But the mysterious anthrax-related deaths of an elderly woman in Connecticut and another woman in New York in cases seemingly unconnected to the postal attacks forced them to reevaluate that stance.

The probe showed that other mail containing faint traces of anthrax had been delivered to addresses near both victims, leading investigators to believe that cross-contaminated mail may have been delivered to the victims. Only trace amounts of anthrax, much less than experts believed would be needed to harm people, were found on the other letters.

Even if cross-contaminated mail was responsible for the two deaths, it's important to remember that tens of thousands of letters went through the same postal sorting machines at about the same time without causing illness. It's now believed that the elderly and people with weakened immune systems may be at a higher risk from cross-contaminated mail. But it's important to keep in mind that the risk is still very, very low.

A little caution will go a long way here. There is no need to wear a mask and gloves to open your personal mail. If you're concerned

about your personal mail, the CDC offers these simple recommendations:

- Avoid holding letters to your nose or sniffing them before opening.
- Don't shake or jostle the contents.
- Wash your hands thoroughly after handling mail.

### **WHEN SHOULD I BE SUSPICIOUS OF A LETTER OR PACKAGE?**

A letter or package should be considered suspicious if it is not addressed to a specific person; is marked with such restrictions as "Personal," "Confidential," or "Do not X-ray"; or is postmarked from a city or state that doesn't match the return address. In addition, exercise caution if the letter or package has excessive postage, misspellings of common words, a strange return address or no return address, a handwritten or poorly typed address, or incorrect titles or a title without a name.

Other suspicious signs include a powdery substance felt through or appearing on the package or envelope, oily stains, discolorations, or odor, a lopsided or uneven envelope, or excessive packaging material, such as masking tape or string.

If a package or letter appears suspicious, don't open it, shake it, or carry it around to show others. Simply put it down on a stable surface. Do not sniff it, touch it, or look too closely at it. Immediately leave the area and make sure anyone else present leaves, too. Shut the door and immediately turn off the ventilation system.

Ensure that all persons who touched the piece of mail wash their hands with soap and water immediately or as soon as possible, and

call 911 (or local law enforcement officials). If feasible, place all items worn when you were in contact with the suspected mail piece in plastic bags and have them available for law enforcement agents. As soon as practical, shower with soap and water.

If possible, create a list of persons who were in the room or area when the suspicious letter or package was recognized and a list of persons who may also have handled the package or letter. Give the list to both the local public health authorities and law enforcement officials.

### **HOW IS ANTHRAX DETECTED IN A BUILDING?**

Testing environmental samples—taken from furniture, mailboxes, and ventilation ducts, for example—is complex and painstaking. It's also very accurate and critically important to determine where and how far anthrax has spread.

At the height of the postal-related outbreak last fall, the CDC looked at more than twenty-five hundred specimens, not just from New York and Washington, but from all over the country. The CDC is to be commended for rising to the challenge. It usually has about ten scientists working on anthrax-related issues, but in response to the mail attacks, it had eighty scientists working seven days a week on the case. It also provided laboratory support to field sites in Florida, New York, Washington, D.C., and New Jersey.

Typically, specimens such as envelopes suspected of anthrax contamination are taken to a biohazard lab, where they are opened under a special hood that sucks air away from the technicians and through powerful filters to keep spores from becoming airborne. The samples are then dissolved or soaked in water, and testing, which includes microscopic examination, culture, and genetic analysis, begins. For safety reasons, technicians working with the samples wear protective gloves, special dispos-

able waterproof gowns, and N95 masks, which filter out tiny particles.

**WE’VE ALL SEEN THE PICTURES OF PEOPLE WEARING “SPACE SUITS” AT THE SITES OF ANTHRAX CONTAMINATION. WHAT ARE THEY WEARING?**

They are wearing disposable protective clothing that primarily protects the skin but also eliminates the likelihood of transferring contamination to other sites. Their respiratory devices are powered, air-purifying respirators, with full-face masks that allow them a full field of vision and are equipped with high-efficiency particulate air (HEPA) filters. Wearing a powered, air-purifying respirator with a full-face mask that has been specifically fitted to the wearer will reduce inhalation exposures by 98 percent. The disposable gloves, which are made of lightweight nitrile or vinyl, provide protection but preserve dexterity. A thin cotton glove is frequently worn under the disposable glove to protect against skin rash, which can occur when hands naturally perspire while inside gloves for prolonged periods.

**HOW IS A BUILDING DECONTAMINATED AFTER ANTHRAX HAS BEEN DISCOVERED?**

There is no established protocol, or detailed procedure, for decontamination of buildings, and indeed the effort has proved far more complex than anyone would have anticipated. The anthrax release in the Hart Senate Office Building in Washington that I chronicled in the opening chapter provides the best example.

The building remained closed for almost three months as the best scientists and environmental experts in the world oversaw the cleanup. The entire building was closed on October 17, after

twenty-eight workers tested positive for exposure. More than half of all senators had to relocate to temporary offices.

On December 1, six weeks after the incident, Sen. Thomas Daschle's suite, where the anthrax-laced letter was opened, was sealed and filled with a high concentration of chlorine dioxide gas. When traces of anthrax were found in 9 of 377 environmental samples taken afterward, the Environmental Protection Agency decided to go back in and fumigate again.

This time, they used the chlorine dioxide gas in the ventilation system in those sections of the building where traces of anthrax were found and the liquid form of chlorine dioxide in the office suite itself. Afterward, a second chemical, sodium bisulfite, was used to break down the gas. One of the problems in deciding when a contaminated building is ready to reopen is that there is no agreed-upon standard of how many anthrax spores constitute a health threat.

Computers, files, and books from the suite were packed up and taken to a company in Richmond, Virginia, for treatment with ethylene oxide, which is commonly used to sanitize medical instruments.

In eleven other senators' offices in the building, liquid and foam forms of the chlorine dioxide and particle-filtering vacuums were used.