

INTERNATIONAL ASSOCIATION OF FIRE FIGHTERS

Smallpox and the Fire Service

Vaccination Guidance for Emergency Responders



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About this document

The information in this document is provided as guidance for fire fighters and emergency medical responders and their employers regarding the smallpox virus and vaccination program. The goal of this document is to strike a balance between protecting our members from this disease and protecting their rights.

The government of the United States believes that there is a threat of a possible biological attack on our civilians utilizing the smallpox virus. Smallpox has significant health effects, including death, for those exposed.

There is no treatment for smallpox and the only effective way of preventing the disease is vaccination. However, there are serious complications and contraindications associated with smallpox vaccination.

The decision whether to receive the smallpox vaccine is a personal one for IAFF members and other first responders. This document was prepared to give you the best possible information on smallpox vaccination so that you can make an informed and educated decision based on your individual circumstances.

Besides ensuring that your employer has adopted a comprehensive vaccination program, you should thoroughly review the pros and cons of smallpox vaccination as outlined in this document. It is your health and, in some cases, your life at stake – and no one can make the decision but you.

The IAFF will continuously update this document as more data is available and as conditions change.

Quick Facts About Smallpox

Signs and symptoms

- Smallpox is caused by the variola virus
- Incubation period is about 12 days (7 to 17 days)
- Mode of transmission
 - Person to person by infected saliva droplets
 - May be spread by contaminated clothing or bedding
 - Most infectious during first week
 - Remain infectious until scabs fall off
- Initial symptoms
 - Fever, fatigue, head and back aches
 - The absence of significant fever prodrome makes smallpox very unlikely.
 - 50% vomiting, 10% diarrhea
 - Characteristic rash within 2 -3 days
 - Begins on face, proximal arms and legs
 - Spreads to chest, distal extremities
 - Most concentrated on the face and distal extremities
 - At any one time, the rash is in the same stage of development on any one part of the body
 - Stages of rash
- Flat, red rash followed in 2 days by
- Papules (small bumps) followed in 4 -5 days by
- Vesicles (fluid-filled) followed in 1 - 2 days by
- Pustules followed in 7 - 14 days by
- Crusts and scabs followed by
- Scabs falling off and scarring (2 - 3 weeks)
- Disease in previously vaccinated persons
 - Vaccination ended in 1972
 - Current level of immunity is unknown
 - Persons are assumed to be susceptible
- Complications
 - Secondary bacterial infections of the skin
 - Keratitis (cornea inflammation) and cornea ulceration
 - Viral arthritis and osteomyelitis
 - Bacterial pneumonia
 - Orchitis (testicle inflammation)

- Encephalitis (brain inflammation)
- Other diagnoses to consider
 - Varicella (chickenpox)
 - Rash begins on trunk, spreads to face and extremities
 - Most lesions are concentrated on trunk or equally distributed between trunk and extremities
 - At any one point in time, rash in different stages
- Diagnostic Tests
 - Clinical presentation
 - Virus culture
 - Skin lesions, oropharynx, conjunctiva, urine
 - Serological testing for antibody
 - Pared samples 2 - 3 weeks apart
 - Hemagglutination inhibition, complement fixation, or gel precipitation
 - DFA and IFA can be used to diagnose varicella-zoster virus
- Case fatality rate 30%

Treatment

- No antiviral treatment available
- Antibiotics for secondary bacterial infections
- Supportive care (fluids, pain, fever)
- Mass vaccination for the general public is not recommended
 - Risk currently outweighs benefits
 - Sufficient vaccine not available

Post-exposure treatment

- The vaccine lessens severity or prevents illness
- Must be given within 4 days after exposure
- Vaccine
 - Live vaccinia virus
 - Does not contain smallpox virus

The vaccine

- A live virus vaccine, vaccinia, related to the smallpox virus

- 95% effectiveness in preventing smallpox
- High level immunity lasting 3 to 5 years
- Vaccination within 3 days of exposure will prevent or lessen symptom severity
- Vaccination within 4 to 7 days may offer some protection or modify symptom severity
- Following vaccination, live virus is present at the vaccination site until the lesion has scabbed over and fallen off
 - Vaccinia virus can be transmitted to other parts of the body or to other people

Contraindications to vaccination

Contradictions to non-emergency smallpox vaccination

- Because the vaccinia virus can be spread to others, persons who have the following conditions, or who live with persons that have the following conditions, should not get the smallpox vaccine:
 - Persons with current or past diagnosis of eczema or atopic dermatitis
 - Persons with active acute or chronic disruptive skin conditions including burns, impetigo, chickenpox, contact dermatitis, shingles, herpes, severe acne, or psoriasis
 - Persons who are immunosuppressed with conditions such as HIV/AIDS, solid organ or stem cell transplants, malignancy, leukemia, lymphoma, agammaglobulinemia, autoimmune disease or receiving immunosuppressant drugs (including inhaled steroids)
 - Persons allergic to the vaccine or any of its ingredients (may contain polymyxin B sulfate, streptomycin sulfate, chlortetracycline hydrochloride, neomycin sulfate)
 - Persons with conjunctival inflammation
 - Infants younger than 12 months
 - Women who are pregnant or plan to get pregnant
 - Women who are breast feeding
 - Persons with a moderate to severe short-term illness

Contraindications to emergency smallpox vaccination

- People who have been directly exposed to the smallpox virus should get the vaccine regardless of their health status

Normal reactions to the vaccine

- Normal primary reaction
 - 3-4 days: papule

- 5-6 days: vesicle with surrounding erythema evolving into vesicle with depressed center
- 8-9 days: well-formed pustule
- 12+ days: pustule crusts over
- 17-21 days: scab detaches, revealing a scar
- Systemic symptoms (usually occur about 1 week after vaccination)
 - Arm soreness and redness at vaccination site
 - Regional lymphadenopathy
 - Low grade fever
 - Malaise, myalgia, headache, chills, nausea, fatigue
 - About 30% of recipients will feel too ill participate in normal activities
- Normal variant reactions
 - Local satellite lesions (that are normal in appearance)
 - Lymphangitis
 - Local edema
 - Viral cellulitis (intense inflammation surrounding papule)

Adverse reactions to the vaccine

- Serious reactions (1000 reactions per 1,000,000 vaccinations)
 - A toxic or allergic rash such as erythema multiforme
 - Accidental self-inoculation of the virus at another body site
 - Bacterial infection of the vaccination site
 - Generalized vaccinia (a rare systemic spread of the virus from vaccination site)
- Life-threatening reactions (14 to 52 reactions per 1,000,000 vaccinations with 1 to 2 deaths)
 - Eczema vaccinatum (widespread vaccinia infection of the skin in persons with skin conditions such as eczema)
 - Progressive vaccinia (ongoing skin infection and necrosis, usually in immunosuppressed persons)
 - Postvaccinal encephalitis

Preventing transmission

- Advise vaccinees and/or guardians that until a scab has formed:
 - Keep the vaccination site covered
 - Do not touch, scratch, or rub the vaccination site
 - Avoid person-to-person contact with susceptible persons (see Contraindications to vaccination)
 - Avoid touching, rubbing, or otherwise performing any maneuvers that might transfer the vaccinia virus to the eye or surrounding skin
 - Discard the vaccination site covering carefully; enclose in a sealed plastic bag
 - After handling the vaccination site covering, thoroughly wash hands

The Disease

What is smallpox?

Smallpox is a contagious, disfiguring and often-deadly disease caused by the variola virus. It is believed to have first appeared in northeastern Africa or the Indus Valley of south-central Asia nearly 12,000 years ago. During its history, it has probably killed more people than any other illness — including the plague.

The last known natural case was in Somalia in 1977. Since then, the only known cases were caused by a laboratory accident in 1978 in Birmingham, England, which killed one person and caused a limited outbreak. Smallpox was one of the world's most feared diseases until it was eradicated in 1979 by a collaborative global vaccination program led by the World Health Organization (WHO). But its potential for use as an agent in biological warfare poses a new and serious threat.

Because it's highly contagious, smallpox has the potential to spread rapidly. Unlike anthrax, which is not transmitted from person to person, a smallpox epidemic could conceivably start with a single infected individual. Particles containing the virus are released into the air when an infected person coughs, sneezes or simply talks. They also may spread through direct contact such as kissing or through contaminated bed linen and clothing. Inhaling a single virus particle may be enough to cause infection. Smallpox causes pus-filled blisters (pustules) on your skin that leave severe, pitted scars. Historically, about one-third of infected people die. There's no known cure, but a vaccine can protect against the disease. In addition, antiviral drugs that have been developed since smallpox was eradicated are now being tested to see if any are effective against the smallpox virus.

The United States discontinued smallpox vaccinations in 1972 because the disease had virtually been eliminated in this country and because the vaccine itself carries potential health risks. In 1980, the World Health Organization (WHO) recommended that all countries discontinue vaccinations.

Nevertheless, stocks of the virus remain. Officially they're stored in only two high-security WHO labs — one in the United States and one in Siberia. But throughout the 1980s, the Soviets carried on a clandestine biological program. Virulent smallpox strains — intended for use as biological weapons — were manufactured in secret labs. Since the collapse of the Soviet Union, some of this stock may have fallen into other hands.

Why is smallpox dangerous?

Smallpox is an acute, contagious disease that can be fatal in up to 30% of those who contract it. There is no specific treatment for smallpox, and the only prevention is vaccination.

Survivors are usually scarred and in rare cases may be blinded. Smallpox can cause a severe rash covering the whole body that can leave permanent scars, high fever, severe headache or backache, dizziness, severe abdominal pain and delirium.

How does smallpox spread?

People with smallpox become contagious when their temperature goes over 101°F (38.3°C), but are most contagious with the onset of rash. They remain contagious until all their scabs fall off.

- A person with the smallpox disease is only contagious through spread of the fluids from the rashes or pustules that develop as a result of the disease. Direct contact with infected skin can transmit the virus. However, the first locations lesions appear are typically inside the mouth. Therefore, coughing, sneezing, speaking and even breathing can spread the virus through saliva droplets expelled from the mouth. As a result, the greatest risk comes from prolonged face-to-face contact (6 feet or less, most often after 1 or more hours), with an infected person. This is particularly troubling for emergency workers because the patient may present with nothing more than a fever and sores inside their mouth that the emergency worker may or may not detect.
- Indirect contact is less efficient at spreading the virus, but can still occur via fine-particle aerosols or inanimate objects carrying the virus. Spread by contact with inanimate objects (e.g., clothing, towels, linens) would be less common, but possible. Special precautions need to be taken to thoroughly clean all bedding and clothing of smallpox patients with bleach and hot water. Disinfectants such as household bleach or hospital-approved quaternary ammonia disinfectants can be used for cleaning contaminated surfaces.
- Animals and insects do not carry or transmit smallpox disease and smallpox is not spread by food or water.

Man-made variations and mutations of smallpox may not behave in the same way that naturally occurring smallpox has in the past. Infection rates, injury rates and death rates may change significantly with an altered smallpox virus. Furthermore, vaccine efficacy may change with engineered smallpox.

How long does the virus survive in aerosol form?

The smallpox virus is fragile. In laboratory experiments, 90% of aerosolized smallpox virus dies within 24 hours; in the presence of ultraviolet (UV) light, this percentage would be even greater. If an aerosol release of smallpox occurs, 90% of virus matter will be inactivated or dissipated in about 24 hours.

What is the incubation period?

This period after exposure and before symptoms is called the incubation period. After exposure, it takes between 7 and 17 days for symptoms of smallpox to appear (average time is 12 to 14 days).

During the incubation period, the infected person feels fine, is not contagious and cannot infect anyone else. An infected individual becomes contagious upon the appearance of a rapidly spreading rash.

What are the initial signs?

The first symptoms of smallpox usually appear 12 to 14 days after infection.

- Following the incubation period, a sudden onset of flu-like symptoms occurs. These symptoms include fever, malaise, headache, severe fatigue and severe back pain.
- A few days later, the characteristic smallpox rash appears as flat, red spots (lesions).
- Within a day or two, these lesions become filled with clear fluid (vesicles) and then with pus (pustules). The lesions appear first on your face, hands and forearms and later on the trunk. They're especially prominent on the palms of your hands and the soles of your feet. Lesions also develop in the mucous membranes of your nose and mouth. The way the lesions are distributed is a hallmark of smallpox and a primary way of diagnosing the disease.

How does it progress?

After the initial signs, the disease progresses in the following manner.

When the pustules erupt, the skin doesn't break, but actually separates from its underlying layers. This can be painful. Scabs begin to form 8 to 9 days later and eventually fall off, leaving deep, pitted scars. All lesions in a given area progress at the same rate through these stages. People who don't recover usually die during the second week of illness.



Fig. 27-1 This series of photographs illustrates the evolution of skin lesions in an unvaccinated infant with the classic form of variola major. (a) The third day of rash shows synchronous eruption of skin lesions; some are becoming vesiculated. (b) On the fifth day of rash, almost all papules are vesicular or pustular. (c) On the seventh day of rash, many lesions are umbilicated, and all lesions are in the same general stage of development. Photographs: Reprinted with permission from Fenner F, Henderson DA, Arita I, Jezek Z, Ladnyi ID. *Smallpox and Its Eradication*. Geneva, Switzerland: World Health Organization (WHO); 1988: 10–14. Photographs by I. Arita.

How does it differ from chickenpox?

In the past, smallpox was sometimes confused with chickenpox — a childhood infection that's seldom deadly. Yet chickenpox differs from smallpox in several important ways.

Chickenpox lesions are much more superficial and occur primarily on the trunk, rather than on the face, arms and hands. In addition, successive crops of lesions tend to develop in the same area. As a result, you'll often see a combination of scabs, vesicles and pustules in someone with chickenpox.

A person infected with chickenpox can unknowingly transmit the virus to others before symptoms develop. Smallpox becomes infectious when symptoms appear and remains contagious until scabs fall from the pustules.

The World Health Organization (WHO) states that smallpox is most contagious after the fever begins and during the first week of the rash. You're less likely to become infected if you're exposed to someone in the latter stages of the disease.

| Table 27-2 DIFFERENTIATION BETWEEN SMALLPOX AND CHICKENPOX | | |
|---|---|--|
| | Smallpox (Variola) | Chickenpox (Varicella) |
| Incubation Period | 7–17 days | 14–21 days |
| Prodrome | Fever and malaise for 2–4 days before onset of rash | Minimal to none |
| Pock Distribution | Centrifugal; usually on palms and soles | Centripetal; seldom on palms and soles |
| Pock Appearance | Vesicular—> pustular—> umbilicated—> scab | Vesicular on erythematous base—> pustular—> scab |
| Evolution of Pocks | Synchronous | Asynchronous |
| Scab Formation | 10–14 days after onset of rash | 4–7 days after onset of rash |
| Scab Separation | 14–28 days after onset of rash | Within 14 days after onset of rash |
| Infectivity | From onset of exanthem until all scabs separate | From 1 days before rash until all vesicles scab |



Chickenpox on the hand Notice the simultaneous occurrence of lesions in different stages of development: macules, papules, vesicles, pustules, and crusts.



Smallpox close-up Notice that all lesions are in the same stage of development and that they are umbilicated.

Can smallpox be treated?

No cure for smallpox currently exists. There is some evidence that Cidofivir — an antiviral medication normally used to treat an infection known as cytomegalovirus (CMV) — might prevent smallpox if it's administered within a day or two of exposure. However, there are no definitive studies to determine if it would be safe and effective in people infected with smallpox. The smallpox vaccine itself can prevent or lessen the severity of the disease if given within 3 days of infection. But neither of these treatments is useful once signs and symptoms develop, and both can have serious side effects. For now, the best that doctors can offer people with symptomatic smallpox are supportive therapy and antibiotics to prevent secondary infections.

Apart from immediate vaccination, isolation is the only way to manage the disease. Unfortunately, isolation can only contain the spread of the virus, not eradicate it.

In most cases, people with confirmed cases of smallpox would be treated in separate hospitals, in other special facilities or at home. Those admitted to regular hospitals are likely to be confined to negative-pressure rooms — the pressure outside the room is greater than the pressure inside — that have highly sophisticated air filtration systems. Strict precautions would be taken with bed linen and clothing. Even so, the risk is so high that all hospital employees as well as most other patients would probably be vaccinated against the disease.

The Vaccine

What is the history of smallpox vaccination?

The story of smallpox prevention — and its eventual eradication through immunization — is a long and compelling one.

For centuries, it was known that people who survived smallpox became immune to it. For that reason, nearly every culture tried to induce immunity in healthy individuals. The Chinese used tubes to insert powdered smallpox scabs into their nostrils. In Turkey, pus from lesions was scratched into the skin.

Eventually these methods — collectively known as variolation — reached Europe and the New World. There, as elsewhere, variolation had varying degrees of success. Some people became immune, but others contracted the disease and died or became the source of a new epidemic. Still, by the early 1700s, "do-it-yourself" smallpox inoculation had become widespread.

In 1788, the scientist Edward Jenner inoculated a healthy, 8-year-old boy with cowpox — a disease caused by a virus that closely resembles variola. Cowpox's natural hosts are small mammals such as wood mice, but the virus can spread to other animals, especially cattle. In cows, the disease causes lesions on the udders and teats that can infect humans who milk them. Although rare today, cowpox was widespread in 18th-century Europe, where it was common knowledge that milkmaids who had been infected with cowpox — which is generally mild — were then immune to the far more deadly disease, smallpox.

Jenner's experiment was a success. His patient failed to contract smallpox, even when deliberately exposed to variola. By 1800, cowpox vaccinations (the word vaccine is from the Latin *vacca*, for cow) were commonplace, primarily because they caused fewer side effects and deaths than variolation with smallpox itself.

Smallpox vaccine that was used in the United States until 1972, when smallpox vaccinations were stopped, contained live vaccinia virus — a virus similar to cowpox and closely related to variola. Before 1972, most young children were vaccinated against smallpox, as were military recruits and many people traveling to other countries.

In 1967, the World Health Organization (WHO) launched a global immunization campaign to wipe out smallpox. At that time, 2 million to 3 million people died of smallpox every year. The WHO efforts were remarkably effective, and the last naturally occurring case of smallpox was reported in Somalia in 1977.

The global eradication of smallpox was verified and certified by a commission of prominent scientists in 1979 and endorsed by the World Health Assembly in 1980. In that year, smallpox vaccinations were discontinued worldwide.

The United States currently is increasing the supply of smallpox vaccine to have enough to vaccinate all Americans. In September 2002, the CDC released to health officials in all the states a contingency plan to quickly inoculate all Americans if the

need should arise. Some experts have recommended "controlled vaccination." This means that in the event of a smallpox outbreak, only people having close contact with infected persons would receive the vaccine.

Such a decision would not be undertaken lightly because the smallpox vaccine also has the small but real potential to cause serious harm. Experts in virology say the vaccinia vaccine causes a fatal complication in about 1 of every 1 million persons who receive it. That means that if the entire American population were to be vaccinated, 300 people would be expected to die of complications from the vaccine. Another 3,000 or so might develop painful sores and severe scars, while 600 others would likely have residual brain damage from encephalitis — a potentially fatal brain inflammation.

The current WHO guidelines also recommend against vaccination of entire populations, citing the risk of severe — and sometimes fatal — reactions to the vaccine. However, WHO officials emphasize that vaccination soon after exposure to the virus can prevent smallpox.

What is the smallpox vaccine?

The smallpox vaccine is the only known method to prevent smallpox and helps the body develop immunity. The vaccine is made from a virus called vaccinia which is a "pox"-type virus related to smallpox. The smallpox vaccine contains the "live" vaccinia virus — not dead virus like many other vaccines. For that reason, the vaccination site must be cared for carefully to prevent the virus from spreading.

How safe is the vaccine?

While the smallpox vaccine is the best protection you can get if you are exposed to the smallpox virus, it has the highest rate of complications of vaccines given to humans. *However, fire fighters, emergency medical personnel and other first responders that are exposed to smallpox should get the vaccination, since the risk of smallpox outweighs the complications associated with the vaccine.*

Pre-exposure smallpox vaccination is the best protection from developing smallpox disease. However, the risk of smallpox attack is uncertain. Some public health experts are critical of the U.S. government's smallpox vaccination strategy because they don't believe the threat of a smallpox attack justifies the inevitable injury and death caused by the vaccine. Furthermore, critics believe, that a post-outbreak vaccination program would adequately protect against smallpox without exposing people to the risks of pre-exposure vaccination.

The risks of the vaccine are based on past experiences. It is estimated that out of one million people:

- 1,000 people vaccinated for the first time will experience reactions that, while not life-threatening, are serious.
- 14 - 52 people vaccinated for the first time will experience potentially life-threatening reactions.

- 1 - 2 people will die.

Some public health experts believe that these projections (based on past experiences with the vaccine) underestimate the risks because there are now more people with immunosuppression and atopic dermatitis.

According to DOD reports, with well over 100,000 vaccinations given, there have been only 3 cases of serious adverse reactions (2 cases of encephalitis and 1 case of myocarditis) and six mild cases of generalized vaccinia. As of March 3, 2003, all of these people have recovered and are back to work. Three percent of those vaccinated have taken sick leave averaging 1.5 days off.

As of March 26, 2003, over 25,645 civilians have been vaccinated. There has been one death that is potentially related to the vaccine, no other life threatening events, 6 moderate to severe events, and 13 serious cases that may or may not have been associated with the vaccine.

Will the new vaccine be safer than the current one?

It is uncertain if the new vaccine, scheduled to begin release in 2003, will be safer than the current vaccine. The current vaccine is made by scratching the virus into the skin of calves. The lymph fluid and tissue fluid is collected and purified and made into a vaccine. The new vaccine uses the same live strain of vaccinia virus, but is grown in a laboratory through tissue-culture. Using the new vaccine may reduce side effects; however the studies to show improved safety have not been completed.

Is it possible to get smallpox from the vaccination?

No. Smallpox vaccine does not contain smallpox virus (variola), but another closely related live virus called vaccinia. Since the viruses are related, vaccination with vaccinia provides immunity against disease from the smallpox virus.

How should I assess my personal risk of getting the vaccine?

Unfortunately, our current ability to decide whether or not to receive the smallpox vaccine is clouded by considerable uncertainty. It is acknowledged that if a smallpox outbreak were to occur, it would, in all probability, be an intentional or terrorist event. In addition, there is some degree of risk associated with receiving the vaccine which is designed to prevent the disease.

The United States Government is not very helpful in this area, since they list the risk of an outbreak as more than 0%, which is hardly useful information. While it is difficult to develop a quantitative model to assess your personal risk, you can consider some qualitative factors that may help you reach a personal decision about receiving the vaccine based on these factors and your own risk aversion.

Here are some of the factors that must be considered:

- Do you reside in an area that is at a perceived risk for a terrorist attack?
- Do you understand that there is no treatment for smallpox?
- Have you studied the adverse impacts of smallpox vaccination outlined in this document?
- Do you have any health conditions, as outlined in this document, which may adversely affect your reaction to the vaccine?
- Do your household contacts or co-workers have any health conditions, as outlined in this document, which may adversely affect them if you are vaccinated?
- Has your decision been thoroughly discussed and reviewed with your family?
- Has your employer adopted a comprehensive vaccination program, including training and medical monitoring, as recommended by the IAFF?
- Has your employer addressed the issue of compensation and leave for individuals that experience adverse reactions from the vaccine?
- Are you, your family, and your employer prepared to deal with any adverse reaction that may result from receiving the vaccination?
- Is your jurisdiction in a densely populated area or near a transportation hub where a potential release is more likely to occur?
- Has your jurisdiction encountered a terror-like incident in your area in the past?
- Does your employer have access to reliable intelligence regarding local terrorist threats?
- Does your employer act to protect members against credible threats?
- Is your local public health agency prepared to rapidly and efficiently implement a vaccination program if an outbreak occurs in your area?

How effective is the vaccine?

Smallpox vaccination provides high-level immunity for 3 to 5 years and decreasing immunity thereafter. If a person is vaccinated again later, immunity lasts even longer.

Historically, the vaccine has been effective in preventing smallpox infection in 95% of those vaccinated. In addition, the vaccine was proven to prevent or substantially lessen infection when given within a few days of exposure. It is important to note, however, that at the time when the smallpox vaccine was used to eradicate the disease, testing was not as advanced or precise as it is today, so there may still be things to learn about the vaccine and its effectiveness and length of protection.

Will vaccination protect me from man-made mutations?

The current smallpox vaccine will prevent all known types of smallpox. It is impossible to determine that the current vaccine will protect against engineered forms of smallpox.

Are those vaccinated before 1972 immune?

Not necessarily. In the United States, routine vaccination against smallpox ended in 1972. The level of immunity, if any, among those vaccinated before 1972 is uncertain; therefore, these persons are assumed to be susceptible. For those who were vaccinated, it is not known how long immunity lasts. Most estimates suggest that the vaccine gives full immunity to disease for 3 to 5 years. This means that a minority of the U.S. population has partial immunity at best. Immunity can be boosted effectively with a single revaccination. Prior infection with smallpox makes a person immune for the rest of their life.

In revaccinated individuals, the risks of complications have been low. Most complications have occurred in patients with underlying diseases or who have received therapy which impairs the immunologic system or those who have not received the vaccine in many years.

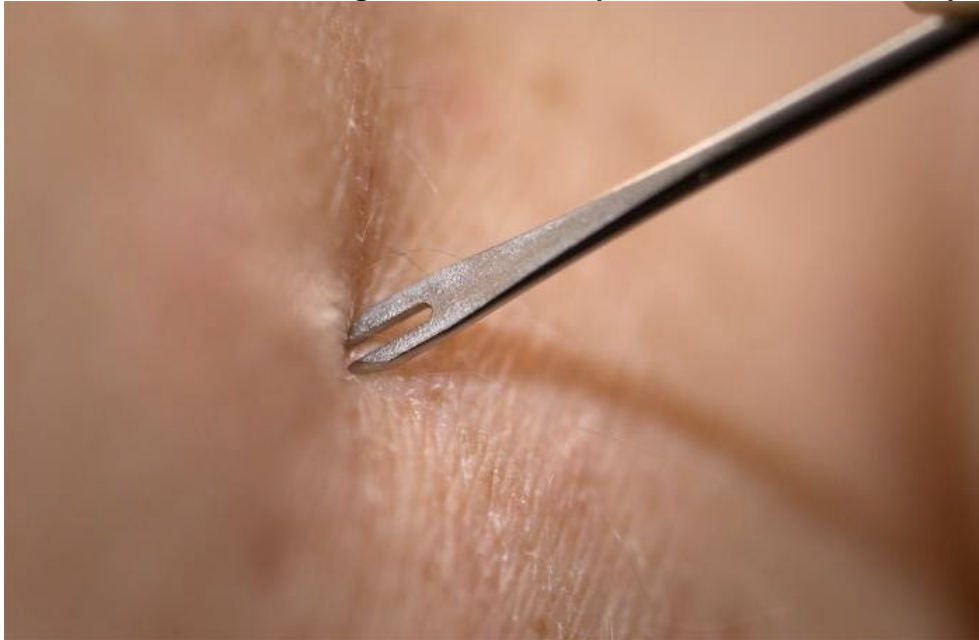
Is it too late to get the vaccine after exposure?

Studies of past smallpox outbreaks showed that vaccination within 4 days of exposure reduced the severity of disease and ensured survival. Some people in these studies showed no signs of disease, some people developed only a few skin lesions, others developed hundreds to thousands of skin lesions (although it is not known if these people really received an effective vaccine within 4 days), however everyone survived the infection. Vaccination 4 to 7 days after exposure likely offers some protection from disease or diminishes the severity of disease. The later someone is vaccinated after exposure to smallpox, the greater the risk of severe disease and death.

How is the vaccine given?

The smallpox vaccine is not given with a hypodermic needle. It is not a "shot," like many vaccinations. The vaccine is given using a bifurcated (two-pronged) needle that is dipped into the vaccine solution. When removed, the needle retains a droplet of the vaccine. The needle is then used to prick the skin a number of times in a few seconds. The pricking is not deep, but it will cause a sore spot and one or two drops of blood to form. The vaccine usually is given in the upper arm.

CDC Clinician demonstrates the use of a bifurcated needle during the 2002 Smallpox Vaccinator Workshop.



How much vaccine is available?

As of March 2003, there is enough vaccine for every citizen in the U.S. The CDC has 15.4 million doses of the Wyeth Dryvax. It can be diluted 1:5 to provide 77 million effective doses. It can be diluted 1:10 with only slightly less efficacy that will yield 154 million doses. Another supply of vaccine manufactured by Aventis Pasteur consists of an additional 80 million doses. It also can be diluted 1:5 for a total of 400 million doses. The addition of these doses from Aventis Pasteur (400 million) and Dryvax diluted 10:1 (154 million) would provide 554 million doses. This is more than enough to handle an outbreak in the United States (population 290 million). Furthermore, Acambis is scheduled to deliver the new vaccine that will be ready for use in 2004 or 2005. The new vaccine may have fewer complications than the current vaccine supply, however this hypothesis has not been tested and proven.

Components of a smallpox vaccination kit including the diluent, a vial of Dryvax® smallpox vaccine, and a bifurcated needle. (2002)



What factors contraindicate the vaccine?

If you have any of the medical conditions listed below, then you have a greater risk of developing complications from the vaccine. The Centers for Disease Control and Prevention (CDC), which is the government agency charged with implementing the administration's smallpox vaccination plan, recommends that *if you have one these conditions, you should not get the vaccine unless you have definitely been exposed to a person with smallpox*. These medical conditions include:

- People with eczema or atopic dermatitis. (This is true even if the condition is not currently active, mild, or experienced as a child.)
- People with other skin conditions such as burns, chickenpox, shingles, impetigo, herpes, severe acne, or psoriasis. (People with any of these conditions should not get the vaccine until they have completely healed.)
- People with weakened immune systems, such as those who have received an organ transplant (kidney, bone marrow, liver, etc.), those who are infected with HIV, or those who are taking high doses of immunosuppressive medications (e.g., prednisone, anti-rejection drugs, chemotherapy, etc.) or are receiving treatment for cancer.
- Women who are pregnant or planning to become pregnant within three months.
- People with serious heart or blood vessel conditions (such as angina, heart attack, artery disease, congestive heart failure, stroke, other cardiac

problem). As of March 26, 2003, the CDC has temporarily deferred people with known heart disease from receiving the vaccine.

The CDC also recommends that the following groups should not be vaccinated unless exposed to smallpox or directed by public health or infectious disease authorities:

- Anyone who lives with or cares for another person with the above conditions, who may inadvertently spread the vaccinia virus. Some states have included households with children less than 1 year of age.
- Anyone who is allergic to the vaccine or any of its components.
- Children under the age of 18.
- Those who have a moderate or severe short-term illness. (These people should wait until they are completely recovered to get the vaccine.)
- Women who are breast feeding.

The CDC recommends that people who have been directly exposed to the smallpox virus should get the vaccine, regardless of their health status.

Should pregnant women be vaccinated?

Pregnant women should **NOT** be vaccinated unless there is a smallpox outbreak because of the risk of fetal infection. Inadvertent transmission of vaccinia virus to a pregnant woman could also put the fetus at risk. Vaccinated persons must be careful to prevent transmission of the vaccine virus to pregnant women or other contacts.

In addition, women who are breast feeding should not get the vaccine.

May I receive the vaccine even if I have contraindications?

No, you may only be vaccinated if you do not have any contraindications to receiving the vaccine. You may review the contraindications to make your personal decision. Any significant medical concerns should be discussed with the on-site physician (according to CDC plan) to your satisfaction and specific testing performed when conditions such as HIV-infection or pregnancy are possibilities. If you are found to have contraindications, then, the medical professional will refuse to vaccinate you.

If you are exposed to smallpox, then you will likely be vaccinated despite contraindications because the risk of the disease exceeds the risk of the vaccine.

In the event of an imminent or documented smallpox outbreak, many individuals with contraindications would be advised to receive the vaccine due to the significant risk of smallpox infection.

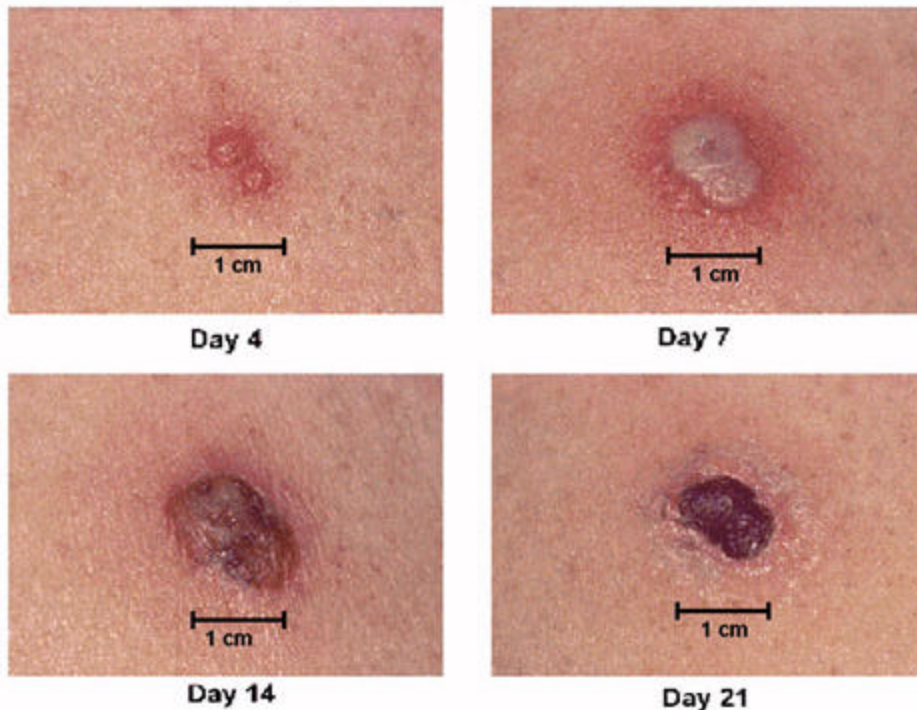
What are normal reactions to the vaccine?

These reactions usually go away without treatment:

- The arm receiving the vaccination may be sore and red where the vaccine was given.
- The glands in the armpits may become large and sore.
- The vaccinated person may run a low fever.
- One out of 3 people may feel bad enough to miss work, school, or recreational activity or have trouble sleeping.

If the vaccination is successful, a red and itchy bump develops at the vaccination site in three or four days. In the first week after vaccination, the bump becomes a large blister, fills with pus, and begins to drain. During week two, the blister begins to dry up and a scab forms. The scab falls off in the third week, leaving a small scar. People who are being vaccinated for the first time may have a stronger "take" (a successful reaction) than those who are being revaccinated.

Primary Vaccination Site Reaction



Major (primary) reaction – Expected vaccine site reaction and progression following primary smallpox vaccination or revaccination after a prolonged period between vaccinations. Multiple pressure vaccination technique used. Source: CDC.

What complications may result?

Serious Reactions

In the past, about 1,000 people for every 1 million people vaccinated for the first time experienced reactions that, while not life-threatening, were serious. These reactions may require medical attention:

- A vaccinia rash or outbreak of sores limited to one area. This is an accidental spreading of the vaccinia virus caused by touching the vaccination site and then touching another part of the body or another person. It usually occurs on the genitals or face, including the eyes, where it can damage sight or lead to blindness. Washing hands with soap and water after touching the vaccine site will help prevent this (inadvertent inoculation).
- A widespread vaccinia rash. The virus spreads from the vaccination site through the blood. Sores break out on parts of the body away from the vaccination site (generalized vaccinia).
- A toxic or allergic rash in response to the vaccine that can take various forms (erythema multiforme).

Life-Threatening Reactions

Rarely, people have had very bad reactions to the vaccine. In the past, between 14 and 52 people per 1 million people vaccinated for the first time experienced potentially life-threatening reactions. These reactions require immediate medical attention:

- Eczema vaccinatum - Serious skin rashes caused by widespread infection of the skin in people with skin conditions such as eczema or atopic dermatitis.
- Progressive vaccinia (or vaccinia necrosum) - Ongoing infection of skin with tissue destruction frequently leading to death.
- Postvaccinal encephalitis (inflammation of the brain).

People with certain medical conditions (including people with weakened immune systems or certain skin conditions) are more likely to have these reactions and should not get the smallpox vaccine unless they have been exposed to smallpox.

Based on past experience, it is estimated that between 1 and 2 people out of every 1 million people vaccinated may die as a result of life-threatening reactions to the vaccine.

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Fig. 27-7. Eczema vaccinatum. The widespread pox lesions on this patient's eczematous skin illustrate the severe illness that can occur in up to 10% of cases. Reprinted with permission from Fenner F, Henderson DA, Arita I, Jezek Z, Ladnyi ID. Smallpox and Its Eradication. Geneva, Switzerland: World Health Organization (WHO); 1988: 298. Photograph by I. D. Ladnyi.



Fig. 27-8. Progressive vaccinia or vaccinia necrosum. As seen in this child, progressive viral replication at the inoculation site in an immunocompromised individual leads to inexorable local tissue destruction. Reprinted with permission from Fenner F, Henderson DA, Arita I, Jezek Z, Ladnyi ID. Smallpox and Its Eradication. Geneva, Switzerland: World Health Organization (WHO); 1988: 298. Photograph by C. H. Kempe.

What are the possible cardiac-related reactions?

Myocarditis is an inflammation of heart muscle tissue (the myocardium). Pericarditis is an inflammation of the sac surrounding the heart (the pericardium). Myocarditis was reported during the 1960s-1970s following smallpox vaccination of military recruits in Finland. At that time, myocarditis was not a recognized complication following vaccination with the U.S. licensed New York City Board of Health strain of smallpox vaccine.

During the recent campaign to boost smallpox immunity in the U.S. population, approximately 350,000 military members received the smallpox vaccine. Among these, 14 people developed chest pain and were subsequently diagnosed with myocarditis and/or pericarditis. All persons affected received smallpox vaccination for the first time. This represents an incidence of roughly 1 in 25,000 myo-pericarditis cases among first-time vaccinees. The 14 people affected experienced clinical conditions that ranged from mild to severe. All 14 persons either recovered or are convalescing.

One active duty military service member suffered a fatal heart attack 5 days after smallpox vaccination. Based on evidence of pre-existing heart disease in this person, the Department of Defense does not consider smallpox vaccination the likely cause of death. However, additional tests and inquiry are being conducted. Among civilians receiving the smallpox vaccine, seven people experienced heart problems, including one person who died following a heart attack. The other six cases included two other heart attacks, two cases of angina and two cases of myo-pericarditis,

largely among people 50 years and older. It is not known if smallpox vaccination caused these problems or if they occurred by chance alone. The CDC continues to investigate these cases.

Currently, the Department of Defense (DOD) and the Centers for Disease Control (CDC) recommend that people with serious heart or blood vessel conditions avoid receiving the smallpox vaccine. Specific conditions that should result in vaccine deferral include: a history of angina, a previous heart attack, artery disease, congestive heart failure, cardiomyopathy, stroke, "mini-stroke," chest pain, or shortness of breath with daily activities (such as walking up stairs). Additionally, DOD, CDC and the American College of Cardiology recommend that people with 3 or more cardiac risk factors avoid smallpox vaccination. Cardiac risk factors include:

- (1) Current smoker or tobacco user
- (2) High blood pressure
- (3) High cholesterol or triglycerides
- (4) High blood sugar, and
- (5) A heart condition before age 50 in a parent, brother or sister.

The CDC has provided screening questions for prospective vaccinees. If you have concerns about your health history, speak with your health care provider before vaccination.

Note: In the event of an actual outbreak of smallpox, a public health emergency would exist. In this case, people who are directly exposed to smallpox disease should get the smallpox vaccine, even those with serious heart conditions.

How may complications be treated?

Two treatments may help people who have certain serious reactions to the smallpox vaccine. These are Vaccinia Immune Globulin (VIG) and Cidofovir. VIG consists of human IgG antibody from people vaccinated with smallpox vaccine. (While some conditions may respond to it, VIG is not effective in treating post-vaccinal encephalitis.)

By the end of December 2002, the CDC projected there would be more than 2,700 treatment doses of VIG (enough for predicted reactions with more than 27 million people) and 3,500 doses of Cidofovir (enough for predicted reactions with 15 million people). Additional doses of VIG are being produced, and measures are underway to increase supplies of Cidofovir as well. VIG and Cidofovir are both investigational treatments and have not been fully approved by the FDA for treatment of smallpox vaccine reactions.

Patients should consult as appropriate with allergy-immunology, infectious-disease, dermatology, neurology, or other specialists about these treatments.

After Vaccination

Will I be monitored after receiving the vaccine?

The primary post-vaccination medical monitoring is the evaluation of the vaccination site at day 6 to 8 to determine if your vaccination "took." This should be done by a medical professional trained to make such determination. After receiving proper training, members should be able to determine if they are experiencing an adverse reaction requiring medical evaluation. The most severe reactions to the vaccine typically occur within 9 days of receiving the vaccination.

Can someone who has been vaccinated spread the vaccinia virus?

Yes. The smallpox vaccine (vaccinia virus) can be spread by direct contact or touching (unlike smallpox, which may be spread by droplets and airborne exposure). It can spread to other parts of the body or to other people from the vaccine site by touching a vaccination site before it has healed or by touching bandages or clothing that have become contaminated with live virus from the vaccination site.

The vaccinia virus may cause rash, fever, headaches, body aches and more serious complications like life-threatening brain and skin infections.

How long after vaccination can vaccinia be transmitted?

From the time of vaccination until the scab from vaccine site falls off and underlying skin is completely healed, the vaccinia virus can be transmitted. This time period is 3 to 4 weeks from the day of vaccination.

Can vaccinia be spread via sneezing?

There is no evidence that vaccinia, the virus in the smallpox vaccination, can be transmitted by contact with oral secretions such as saliva from sneezing. Vaccinia is only contagious through direct contact with the vaccination site. That is why proper vaccination site management and hygiene are important in preventing its spread.

How should I care for the vaccination site?

Spreading can be prevented through proper care of the vaccination site, including:

- Thorough hand washing
- Proper bandaging
- Careful disposal of used bandages

For fire fighters and emergency medical personnel, the vaccination site should be covered by gauze followed by a semi-permeable bandage (like Opsite®) when on duty. All activities are acceptable with this dressing in place including showering and exercise. The only restriction is to avoid complete submersion in water (swimming, bathing).

This bandage should be checked every duty day to ensure that it is intact (no fraying) and is not saturated with secretions from the vaccination site. It should be changed every three days without regard to the condition of the bandage. It should be changed sooner if the bandage has frayed edges, is falling off or is saturated with vaccination site secretions (drainage, pus). For added protection, a shirt covering the vaccination site should be worn.

This method was tested for durability in a group of fire fighters. The combination gauze and semi-permeable bandage was placed over normal skin on the upper arm approximating the vaccination site. The fire fighters performed normal activities at home and at work. They also ran for 30 minutes, ran on a treadmill in turnout gear for 15 minutes and lifted weights for 20 minutes in turnout gear daily. After 3 days, none of the bandages had frayed or fallen off.

At home, fire fighters and emergency medical personnel should continue to use a duty bandage. You may leave an intact duty bandage in place for 3 days even if you are at home. If you are at home when it is time to change the duty bandage, then you should replace it with another duty bandage. Again, you may shower and exercise, but do not submerge the site in water (bathing, swimming).

Can ointments or creams be used on the vaccination site?

No. Let the site heal. The site should be bandaged only for purpose of preventing spread of the virus, not to improve healing. Ointments and medicines will only delay healing. While on duty, it is important that the vaccination site be covered with gauze and a semi-permeable bandage, which your employer should provide, to prevent spreading the vaccinia. Unfortunately, there are no topical medications that can be applied to prevent the characteristic itching.

What are the procedures for proper bandage disposal?

While on duty fire department employees should place their used bandages in the Bio-Hazard (red bags) located in every fire station. However, the CDC has indicated that while at home, used bandages can be safely placed in sealed zip lock bags and disposed of in the ordinary household trash.

What if I get cut in the area of the vaccination?

Remember the only potential for spread of the vaccinia virus is through direct contact with the site. In this scenario, any object that comes in contact with the vaccination site or blood from the vaccination site needs to be cleaned with a bleach solution. The old bandages need to be properly disposed of and new bandages applied. If uniforms or protective clothing are affected, they should be cleaned according to the manufacturer's instructions.

What procedures should be used in the firehouse?

Once personnel begin to receive vaccinations, sleeping quarters should be designated for either vaccinated or unvaccinated personnel. The vaccinated personnel must maintain bandaging over the vaccination site at all times and wear shirts with sleeves long enough to cover the bandages. (This includes while sleeping.)

Separate beds should be designated for the vaccinated and unvaccinated, and linen must not be shared.

The employees should not share sleeping materials (pillows, linens, blankets). Vaccinated employees must use a sheet over the mattress cover. No sleeping materials are to be left by employees in bunkrooms for vaccinated employees and vaccinated employees are not to borrow any sleeping supplies. It is recommended that all bedding materials and clothes that come in contact with the vaccination site be kept together and washed with hot water and detergent. Always wash your hands afterwards. This practice is recommended both at work and in the home environment.

PPE cannot be washed with bleach or hot water (at temperatures exceeding 105°F). The proper washing procedure for PPE that is potentially exposed to the vaccinia virus is washing in the station laundry machine designated for running gear in cold water with a liquid detergent. The article of PPE should be washed twice.

Can vaccinees share PPE?

Vaccinated employees are not to share any protective clothing with other employees if at all possible. If anyone with an unprotected vaccination site dons a turnout coat, the coat must be immediately washed according to the PPE cleaning guidelines provided in *NFPA 1851, Standard on Selection, Care, and Maintenance of Structural Fire Fighting Protective Ensembles*.

Can a recently vaccinated fire fighter treat patients?

Yes. Most experts believe that vaccinated fire fighters can safely treat patients as long as they are following instructions for site care. There was one recommendation from the Advisory Committee on Immunization Practices (ACIP) which did recommend attempting to avoid allowing vaccinated fire fighters from treating unvaccinated patients. However, the ACIP went on to recognize that such precautions may not be practical and agreed that the aforementioned precautions are an acceptable practice for vaccinated firefighters remaining on the job.

Can I be placed on light duty while recovering from the vaccine?

Fire fighters and emergency responders should be able to continue working in a full duty status. If they should experience adverse reactions from the vaccination, they may be placed on either light duty or disability. The physician providing follow-up care for the adverse reaction will make this determination.

The number of fire fighters who are likely to have a reaction to the vaccination that results in the employee missing work is another area where there is some variance in the opinions of the experts. The CDC stated in one publication that 1 in 3 people receiving the vaccine will miss some work. Other experts feel the number of adverse reactions will be much less. This issue is, in part, why there is a delay in the initiation of Phase 2. Detailed analysis of the reactions experienced by the Phase 1 personnel receiving the vaccination could help to more accurately anticipate these types of issues.

Can recent vaccinees work out in a gym?

There is no reason that the vaccinee (person recently vaccinated) cannot work out in a gym; however, care must be taken to ensure that the vaccination site is covered with the duty bandage (gauze and semi-permeable bandage). Vaccinees also should wear a shirt that covers the site.

Should a household bath or shower be sanitized after use?

It is not necessary to sanitize the bathtub or the sink after use. Clean any surface that you place a dirty bandage upon with any disinfectant. Clean any surface or object that rubs against your uncovered vaccination site.

How should I care for personal laundry?

If you continually wear the duty bandage, then the vaccination site will be covered at all times and the chances of contaminating personal items will be small. If possible, wear personal clothing that is washable with hot soapy water. Keep your personal linens and clothing that have contacted the vaccination site separate (e.g., towels) from the rest of the family's. Work/station uniform and personal protective equipment should not be taken home.

Cold water alone will not kill the vaccinia virus, if it is on the clothes, but the detergent will. You should try to wear clothing that is washable in hot water, if possible.

It is unclear whether or not dry cleaning will kill the vaccinia virus. Until we have an answer, we recommend that you wear a washable shirt under your dry cleanable clothing to avoid contact with the vaccination site.

As a precaution, any item that has potentially contacted the vaccine site should be kept separate from other clothing and washed with hot water and detergent.

Can I have sexual intercourse after vaccination?

Yes. Keep the site covered with a duty bandage and wear a shirt with sleeves that cover the site as an added precaution.

Should I sleep in a separate area at home after vaccination?

If the vaccination site is covered with a duty bandage, separate sleeping areas are not necessary. It will be the individual's choice to opt for separate sleeping areas if that provides a better sense of security for your family.

If a family member has a contraindication to the vaccine, then the fire fighter should not be vaccinated.

How should I care for bed linens at home?

With an intact duty bandage, the vaccination site should never come into with the linen. Wash your linen, along with personal towels and washcloths in hot soapy water as a precaution only.

As a precaution, any item that has potentially contacted the vaccine site should be kept separate from other clothing and washed with hot water and detergent.

Protection

What PPE is required to protect me from a smallpox vaccinee?

First and foremost, universal emergency medical precautions shall be practiced.

Again, the only threat to providers when treating a patient who has been vaccinated is the potential for direct contact with the vaccination site. As long as the site is properly covered, the emergency responder only needs to be mindful of avoiding contact with that area.

If the site is not covered, the emergency worker would be well advised to wear protective gloves as we do on all EMS emergencies and cover the site (Gloves meeting the emergency medical examination glove requirements in *NFPA 1999, Standard on Protective Clothing for Emergency Medical Operations*, are recommended). The gloves should then be disposed of in a proper biohazard disposal bags and hands thoroughly washed. Suitable procedures are provided in *NFPA 1581, Standard on Fire Department Infection Control Program*.

What PPE is required to protect me from smallpox exposure?

The employer shall have adopted the requirements contained in *NFPA 1581, Standard on Fire Department Infection Control Program* and universal emergency medical precautions shall be practiced.

The CDC has recommended using N95 mask for anyone caring for a smallpox patient. However, this recommendation is based on the experience of hospital workers in a controlled setting that is unlike the uncontrolled environment in which fire fighters and emergency responders work. These differences raise the concern that N95 masks may not offer adequate protection to fire fighters and emergency medical responders. Similar concerns were raised with the anthrax terrorist attacks. These concerns prompted the IAFF to send a letter to NIOSH in October 2001 requesting recommendations for the selection of protective clothing and equipment for response to incidents involving suspected biologic agents. In response to this request, the CDC and NIOSH released recommendations for the selection and use of protective clothing and equipment when responding to suspected biologic agent incidents, including smallpox.

The employer shall implement the following NIOSH recommendations:

- Fire fighter turnout gear should not be worn when responding to suspected biologic agent incidents because appropriate decontamination procedures may damage some of the protective fabrics.
 - NOTE: The IAFF recognizes that fire fighters initially responding to an incident may not know it is a WMD event involving a biological agent

and will be in their turnout gear. If the incident involved the aerosol release of the smallpox virus, clothing should be removed, properly bagged and either decontaminated with a non-chlorinated anti-viral product or disposed.

- Incident Scenario 1: Suspected biologic agent, dissemination of suspected agent by letter or package, letter or package can be easily bagged, and an aerosol generating device was not used.
 - NIOSH PPE Recommendation: Full face respirator with a P100 filter or a power air purifying respirator (PAPR) with a high efficiency particulate air (HEPA) filter. Also use disposable hooded coveralls, gloves, and foot coverings (Level C).
- Incident Scenario 2: Suspected biologic agent, aerosol is no longer being generated, splash hazard may exist. (Exposure would be from contaminated surfaces or individuals.)
 - NIOSH PPE Recommendation: NIOSH approved SCBA with Level B* protective suit.
- Incident Scenario 3: Suspected biologic agent, dissemination via aerosol device is still occurring or has stopped but there is no information on the duration of dissemination or exposure concentration.
 - NIOSH PPE Recommendation: NIOSH approved SCBA with Level A* protective suit.
- Decontamination:
 - Follow decontamination sequences currently used for hazardous materials incidents as appropriate to the level of PPE employed.
 - Equipment can be decontaminated with soap and water and 0.5% hypochlorite solution (one part household bleach to 10 parts water).
 - After taking off gear, emergency response employees should shower using copious quantities of soap and water.

*NOTE: The traditional EPA/OSHA levels A, B, C, and D classifications used for hazardous materials ensembles do not accurately describe the protective ability of ensembles for WMD protection. The federal government and the first responder community, through the InterAgency Board for Equipment Standardization and InterOperability now recognize that protective ensembles must not use these classifications.

Where NIOSH recommends a "Level A protective suit," protective garments from the following options should be selected:

- *NFPA 1991 Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies Ensembles with Optional Chemical/Biological Terrorism Protection.* Include full-body, totally-encapsulating suits with gloves and footwear that provides a high level of protection against hazardous chemicals in accordance with NFPA 1991 and chemical and biological agents in accordance with the optional NFPA 1991 chemical/biological terrorism protection requirements. Respiratory protection is provided by a self-contained breathing apparatus (SCBA).

- *NFPA 1994 Standard on Protective Ensembles for Chemical/Biological Terrorism Incidents Class 1 Ensembles.* Include full-body, totally encapsulating suit with gloves and footwear that provides highest level of protection against chemical and biological agents in accordance with the Class 1 requirement of NFPA 1994. Respiratory protection is provided by a self-contained breathing apparatus. A Class 1 ensemble is used to protect fire and emergency services personnel at chemical/biological terrorism incidents where the identity or concentration of the vapor or liquid agent is unknown, or where it is necessary to provide vapor protection, or where liquid contact is expected and no direct skin contact can be permitted as exposure of personnel at these levels will result in the substantial possibility of immediate death, immediate serious incapacitation, or the ability to escape will be severely impaired.
- *NFPA 1994 Standard on Protective Ensembles for Chemical/Biological Terrorism Incidents Class 2 Ensembles.* Include full-body, encapsulating suit option only, with gloves and footwear that provides an intermediate level of protection against chemical and biological agents in accordance with the Class 2 requirements for NFPA 1994. Respiratory protection is provided by a self-contained breathing apparatus (SCBA). A Class 2 ensemble is used to protect fire and emergency services personnel at chemical/biological terrorism incidents where it is necessary to provide sufficient vapor protection for the intended operation, where direct contact of liquid droplets is probable, and where victims are not ambulatory but symptomatic.

Where NIOSH recommends a "Level B protective suit," protective garments from the following options should be selected:

- *NFPA 1994 Standard on Protective Ensembles for Chemical/Biological Terrorism Incidents Class 2 Ensembles.* Include non-encapsulating suit option with gloves and footwear that provides an intermediate level of protection against chemical and biological agents in accordance with the Class 2 requirements for NFPA 1994. Respiratory protection is provided by a self-contained breathing apparatus (SCBA).
- *NFPA 1992 Standard on Liquid Splash-Protective Ensembles and Clothing for Hazardous Materials Emergencies Ensembles.* Include full-body, totally-encapsulating or non-encapsulating suits with gloves and footwear that provides a high level of protection against liquid splash from hazardous chemicals. Respiratory protection is provided by a self-contained breathing apparatus (SCBA).

Where NIOSH recommends a "Level C protective suit," protective garments from the following option should be selected:

- *NFPA 1994 Standard on Protective Ensembles for Chemical/Biological Terrorism Incidents Class 3 Ensembles.* Include non-encapsulating suit option with gloves and footwear that provides an intermediate level of protection against chemical and biological agents in accordance with the Class 3 requirements for NFPA 1994. Respiratory protection is provided by a self-contained breathing apparatus (SCBA). A Class 3 ensemble is used to protect fire and emergency services personnel at chemical/biological terrorism incidents where it is necessary to provide sufficient liquid protection for the

intended operation, where direct contact of liquid droplets is possible, and where victims are impaired but ambulatory.

Learn More

- NIOSH "Interim Recommendations for the Selection and Use of Protective Clothing and Respirators Against Biological Agents" - <http://www.cdc.gov/niosh/unp-intrecppe.htm>
- NFPA standards - <http://www.nfpa.org/Codes/CodesandStandards/HazMat/HazMat.asp>
- InterAgency Board for Equipment Standardization and InterOperability (IAB) - <http://www.iab.gov>

What PPE is required to protect me from a smallpox vaccinee?

First and foremost, universal emergency medical precautions shall be practiced.

Again, the only threat to providers when treating a patient who has been vaccinated is the potential for direct contact with the vaccination site. As long as the site is properly covered, the emergency responder only needs to be mindful of avoiding contact with that area.

If the site is not covered, the emergency worker would be well advised to wear protective gloves as we do on all EMS emergencies and cover the site (Gloves meeting the emergency medical examination glove requirements in *NFPA 1999, Standard on Protective Clothing for Emergency Medical Operations*, are recommended). The gloves should then be disposed of in a proper biohazard disposal bags and hands thoroughly washed. Suitable procedures are provided in *NFPA 1581, Standard on Fire Department Infection Control Program*.

Under what circumstances will I be covered by workers' compensation?

Regardless of whether or not you receive the vaccine, if you are exposed to smallpox while on duty and develop the disease, you should be covered by your employer's workers' compensation. However, this issue must be addressed prior to the implementation of the vaccination program.

Workers' compensation coverage can vary between states. There is proposed federal legislation that would offer some protections secondary to state coverage. There is currently federal legislation that would provide some coverage if you get sick from the vaccine and have to retire, but it has yet to become law.

A limited number of states and some self-insured employers have stipulated that employees suffering complications from having received the vaccination are covered. There is not a presumption, however, that covers vaccinia infection from other means. Therefore, if you get the vaccine and infect a fire department co-worker,

causing that person to retire, will that individual would not be covered under a presumption law and the case would be handled like any other communicable disease. It would be incumbent upon the employee to prove a specific time and place they were exposed and subsequently developed the infection. That may be difficult.

Family members are not covered under current workers' compensation law. However, there are a number of states that are addressing legislation to provide limited coverage to family members.

Issues of Risk

How dangerous is the smallpox threat?

Smallpox is one of the agents (along with anthrax, plague, botulism, tularemia, and viral hemorrhagic fevers) believed to pose the greatest potential threat to public health. It has a moderate to high potential for large-scale dissemination. Once disseminated, it may spread from person to person resulting in both national and international epidemics.

What is the government's plan to prevent a smallpox terrorist attack?

The federal government's pre-event vaccination plan consists of three phases of vaccination.

- **Phase 1** of the plan offers voluntary vaccination to public health officials and to designated health care smallpox response teams and mandatory vaccination of certain military members.
- **Phase 2** would expand the number of people voluntarily vaccinated to include additional "first responders" (such as fire fighters, law enforcement officers, and emergency medical service personnel). There will be some fire fighters vaccinated prior to Phase 2 because they serve as military reservists.
- **Phase 3** would provide voluntary vaccination to the general public.

Each state has been directed by the CDC to develop a smallpox response plan based on CDC guidelines to be implemented if there is a smallpox outbreak. The CDC guidelines have been developed to provide direction to state and local health officials for responding to a smallpox emergency. The plan identifies many of the federal, state, and local public health activities that need to be undertaken in a smallpox emergency. It also provides guidelines for many of the general public health activities that would be undertaken during a smallpox emergency. The current plan is to utilize the ring concept to vaccinate and monitor a "ring" of people around each case and contact. If the outbreak was too large to effectively employ the ring strategy, then there likely would be mass vaccinations.

What is the government's plan to address an outbreak?

The CDC is planning to use the ring vaccination concept, if there is a smallpox outbreak. Smallpox was eliminated globally using a ring vaccination strategy. As an outbreak of smallpox was detected, public health representatives vaccinated the

surrounding population. However, studies indicate a ring vaccination strategy may not effectively contain a smallpox outbreak from a bioterrorist attack.

The ring concept involves vaccinating and monitoring a “ring” of people around each case of smallpox and their contacts to help protect those at the greatest risk for contracting the disease as well as forming a buffer of immune individuals to prevent the spread of disease outside the ring. Ring vaccination includes quarantining all confirmed and suspected smallpox cases and the tracing, vaccination, and close surveillance of contacts to these cases as well as vaccination of the household contacts of the contacts. Depending upon:

1. The option for outbreak control that is selected,
2. The size of the outbreak,
3. Personnel resources,
4. Effectiveness of other outbreak control measures, and
5. Vaccine availability,

the size of the vaccinated “ring” of individuals surrounding a case or contact may be modified (expanded or contracted).

A terrorist attack with a biological weapon, such as smallpox, would most likely include the release of the biological agent in a large public area (e.g. office building, movie theater, sporting facility). Smallpox has a long incubation period of 10 to 17 days from the time of infection. People with smallpox can spread the disease to others after they have developed a rash and fever. The long incubation period makes it very likely that some of the infected people will travel and infect others with smallpox before the disease is recognized and quarantine can be implemented. The result will be an “initial” outbreak of smallpox that includes both primary and secondary infections and affects many more people than were infected in the terrorist attack.

It has been reported that, even with a sufficient supply of smallpox vaccine, a quarantine enforced by police would probably not be effective in controlling an outbreak of smallpox. These studies doubt the speed at which an outbreak could be accurately identified, and note that the increase in worldwide travel would carry the disease too quickly for containment by ring vaccination. Should an outbreak of smallpox occur, however, we would know with certainty that it did not occur naturally. Therefore, there is little reason to believe that the outbreak will act in a familiar manner. A bioterrorist attack using smallpox might be staggered across time and locations. Any attempt to control an outbreak using ring vaccination could be quickly subverted by a strategic release of additional smallpox virus.

In the case of a terrorist attack, which may involve a large multi-site outbreak, a mass vaccination plan may be implemented as opposed to ring vaccinations.

Is an intentional release more likely to occur in a densely populated area?

Though it is difficult to predict the thinking of those who might initiate an intentional attack, the past history has been to attack either high-density facilities (such as the World Trade Center) or those closely associated with the U.S. Government (such as U.S.S. Cole, U.S. Embassies, Khobar Towers, etc).

Is an intentional release more likely to occur near a transportation hub?

Where a biological attack is under consideration, transportation hubs could be attractive, especially since large numbers of people could be exposed to a pathogen.

When is quarantine necessary?

Vaccination does not require quarantine. The only protection required is proper vaccination site care.

If exposed to smallpox, it is likely that you will be quarantined to ensure that the disease does not develop and spread. Quarantine with respiratory isolation may be applied to those exposed for up to 17 days post-exposure.

Quarantine is required, if you develop smallpox.

Employer Responsibilities

Overview

The International Association of Fire Fighters has assessed all aspects of the smallpox issue over the last 18 months, dating back to late September 2001 (following the 9/11 attacks) when IAFF General President, Harold A. Schaitberger, urged Health and Human Services Secretary Tommy Thompson to take action on smallpox and anthrax threats to fire fighters and other first responders. The IAFF has urged all its affiliates and their fire department management to consider the specific risk to their communities before deciding whether to vaccinate their fire fighters. The IAFF has further addressed all the medical risks associated with the vaccine, even if the state or local program follows all federal government and IAFF recommendations.

In December of 2002, the IAFF advised all of its members not to proceed with smallpox vaccinations, if their employer failed to agree to a comprehensive smallpox vaccination program, developed by the IAFF and derived from and consistent with recommendations from the Department of Health and Human Services (HHS), the Centers for Disease Control and Prevention (CDC), the Department of Defense (DOD) and the Advisory Committee on Immunization Practices (ACIP).

Even if your employer fully adopts a comprehensive program, the decision whether to receive the smallpox vaccine remains a personal one for IAFF members and other first responders. The goal of the IAFF's efforts is to provide every IAFF member with the best possible information on smallpox disease and vaccination so each fire fighter and other first responder can make an informed and educated decision based on his or her individual circumstances.

The IAFF is also continuing with legislative efforts – at the federal and state levels -- that will provide a fair compensation system to assist our members and their families who may be injured from receiving the vaccine or coming into contact with someone who received it.

Comprehensive smallpox vaccination program

The IAFF believes that before any vaccination program is initiated by the employers of our membership, each of the IAFF-endorsed provisions detailed below must be fully implemented.

The IAFF recommends that:

- Smallpox vaccinations shall be made available, at no cost, by their employer to all fire fighters and emergency medical personnel and such vaccinations shall be provided while the employee is on duty.
- Fire fighters or emergency medical personnel shall be entitled to decline the smallpox vaccine. Any employee who declines to receive the vaccine shall not be subject to discrimination at work. If an employee declines to receive the

vaccination, he/she must sign a waiver. The waiver shall include the following language (language is consistent with waiver language promulgated by U.S. OSHA for hepatitis B vaccination and Section 4(b)(4) of the OSH Act):

"I understand that due to my occupation, I may be at risk of being exposed to and acquiring smallpox. I have been given the opportunity to be vaccinated with smallpox vaccine, at no charge to myself. However, I decline the smallpox vaccine at this time. I understand that by declining this vaccine, I continue to be at risk of acquiring smallpox, a serious disease. If in the future I want to be vaccinated with the smallpox vaccine, I can receive the vaccination at no charge to me. My statement of declination of smallpox vaccination is not intended to supersede or in any manner affect any workers' compensation law or to enlarge or diminish or affect in any other manner to common law or statutory rights, duties, or liabilities of employers and employees under any law with respect to injuries, diseases, or death of employees arising out of, or in the course of, employment. I also understand that I will not be discriminated against by my employers if I decline to be vaccinated."

- Any waiver or consent form which releases your employer from any responsibility for reactions that may occur from the immunization is unacceptable, inconsistent with federal OSHA rulings, and must not be signed.
- If an employee initially declines vaccination but decides later to get vaccinated, the employer shall make the vaccine available at no cost. If at some point the U.S. Public Health Service recommends that people who have had the vaccination should be revaccinated, they shall be made available to all employees at no cost.

Education and training

Prior to vaccination employees shall receive training, which shall be provided at no cost during working hours to all fire fighters and emergency medical personnel. The training must include at a minimum:

- General explanations of the epidemiology and symptoms of smallpox;
- Specific information on how smallpox is transmitted, including modes of delivery as a weapon;
- Actions and procedures to be followed in the event of exposure;
- The employer's exposure control plan and how the employees can obtain a copy;
- Information on how to recognize tasks that may involve exposures to smallpox;
- Up-to-date information on the vaccinia (smallpox) vaccine;

- The method of vaccination and the spectrum of normal and adverse vaccination reactions, including the benefits, the risks and the fact that it is provided at no cost to the employee;
- Risks to non-vaccinated family members and fellow employees;
- Specific information on vaccination-site care;
- Copies and explanation of all CDC and DOD protocols on the subject of smallpox;
- A description of the post-exposure evaluation;
- The methods (and limitations of those methods) that may prevent exposures to smallpox, including personal protective clothing and equipment (PPE), work practices and decontamination;
- The selection of appropriate PPE; and
- The proper use, location, removal, handling, decontamination and disposal of PPE.

The employers shall formally educate employees through procedures and training, of the risks of close physical contact with family members, including those who may have risk factors and infants less than one year old. Employees must be instructed that, while off-duty, vaccination site care (including bandaging and wearing of long sleeved shirts) must continue and that continued hand-hygiene is essential.

The employer shall also inform employees that blood donations must be deferred until the scab spontaneously separates from the vaccination site or if the scab is otherwise removed, blood must not be donated for at least two months after the date of vaccination. Any employee who had any vaccine complication must defer donation of blood until fourteen (14) days after complications have been completely resolved.

Medical assessment

It is essential to medically screen vaccine recipients, their family and fire station contacts for contraindications before vaccination to prevent serious complications. While the standard of practice for all immunizations requires medical screening, smallpox vaccination is unique in that there is a need to screen for risks among family/household contacts and employee contacts in the fire station.

Prior to vaccination the employer shall provide medical screening to ensure the vaccine is not contraindicated for medical reasons. Such reasons shall be:

- Weakened immune system (Note: cancer treatment, an organ transplant, HIV, or medications to treat autoimmune disorders and other illnesses can weaken the immune system).
 - Any fire service member who is concerned that they could have HIV infection may request and the employer shall provide confidential HIV

testing. The confidential results shall be reported to the potential vaccinee before vaccination, and the results of the test and the fact that the test was requested shall remain confidential and not recorded in the medial file.

- HIV testing is recommended for anyone who has a history of risk factors for HIV infection or is not sure of his or HIV-infection status. Anyone who is concerned that they may be HIV-infected should request confidential screening prior to smallpox vaccination.
 - Any fire service member who has a weakened immune system due to medical treatment (i.e. cancer drug or radiation) or chronic steroid use.
- Employees with eczema or atopic dermatitis should not get the vaccine even if the condition is not currently active, mild or experienced as a child.
 - Acute, chronic or exfoliative skin conditions such as burns, chickenpox, shingles, impetigo, herpes, severe or uncontrolled acne or psoriasis. Employees with any of these conditions should not get the vaccine until the condition has resolved or a physician affirms it is under maximal control. However, employees with contraindicated skin conditions who received smallpox vaccine earlier in life may be revaccinated after medical consultation for individual risk-benefit decision making.
 - Pregnancy or plans to become pregnant within three months of vaccination. Vaccine shall not be provided during pregnancy nor shall it be provided to employees who live in a household with a pregnant individual
 - Women of childbearing potential shall be provided with screening/questioning for pregnancy before receiving immunizations. Any woman who is uncertain about pregnancy status shall be medically tested for pregnancy before immunization. Vaccination shall be deferred for pregnant women at least until resumption of full duties following pregnancy, or later as postpartum care may require, or while they are currently breast feeding.
 - Employees with known heart disease.

In addition, individuals should not get the smallpox vaccine if they:

- Are allergic to the vaccine or any of its ingredients.
- Have a moderate or severe short-term illness. These people should wait until they are completely recovered to get the vaccine.
- Have a history of chronic use of steroids.

Employees who have any of the above conditions, or live with someone who does, should **NOT** get the smallpox vaccine unless they have been directly exposed to the smallpox virus.

If directly exposed to the smallpox virus, fire fighters and EMS personnel who were not vaccinated should get the vaccine immediately, regardless of their health status. If exposed, the risk of smallpox outweighs the complications associated with the

vaccination. After an exposure, any non-vaccinated employee must be quarantined until vaccinated and medically released.

Vaccinations

The vaccine shall only be made available after the employee has received the required training and after the employee has been medically evaluated.

Vaccinations are to be given by or under the supervision of a licensed physician or other health care professional according to the recommendations of the U.S. Public Health Service. The employer shall ensure that health care professionals used for vaccinating their employees remain alert to modifications in clinical recommendations as the smallpox vaccination program progresses. The employer shall implement a quality assurance program to assess vaccination technique of vaccinators.

The vaccination is usually provided at the deltoid muscle of the non-dominant arm, avoiding any skin conditions, tattoos or skin folds. The vaccination consists of three (3) punctures with a bifurcated needle for individuals who were never vaccinated or fifteen (15) punctures for those who have been previously vaccinated or for vaccination retakes.

An assessment of vaccine take is required for all vaccinees. The employer shall ensure that medical personnel trained in vaccination evaluation inspect the vaccination site of all vaccinees at six (6) to eight (8) days after vaccination administration. All employees shall be instructed to report if they do not develop a characteristic smallpox vaccination reaction.

If a characteristic vaccination reaction does not manifest within six (6) to eight (8) days after smallpox vaccination, the employee shall be provided with revaccination. Such revaccination shall only be repeated once. For those individuals who do not respond to vaccination with a visible skin lesion, referral for immunologic evaluation is required.

Adverse reactions

Any individual who experiences any adverse reaction from the smallpox vaccine shall be provided with immediate medical and follow-up care at no cost to the employee.

Any fire fighter or emergency medical personnel who has an adverse reaction to the smallpox vaccine and is unable to perform his/her duties shall be entitled to receive occupational disability benefits as provided by the employer for on-duty injuries/illnesses for the duration of the disability. Any leave of absence associated with an adverse reaction shall be immediately classified and treated as a line-of-duty injury. All medical costs associated with the vaccination and adverse reaction treatment shall be borne by the employer.

The IAFF will continue with legislative effects that will provide a fair compensation system – like the federal Vaccine Injury Compensation Fund – to assist our members

and their families who may be injured from receiving the vaccine or coming into contact with someone who received it. Vaccine manufacturers and those who administer it have been offered immunity from liability through recent Homeland Security legislation.

If an employee experiences any adverse reaction to the vaccine, the employer shall immediately file a Vaccine Adverse Event Reporting System (VAERS) form. Additional information on filing a VAERS report can be found at the following CDC/FDA Web site: <http://www.vaers.org>.

Vaccination-Site Care

The virus used in the vaccination (vaccinia) can be cultured from the site of the vaccination beginning at the time of development of a papule (two to five days after vaccination) and until the vaccination scab separates from the skin. During this entire period, the employee must care for the site to prevent spread of this virus to another area of the body or to another person through inadvertent contact.

Site care will also assist in preventing any secondary infection. High-risk individuals may be especially vulnerable to virus shedding and scab particles from a vaccinated employee during the post-vaccination healing period.

Hand washing is the most important measure to prevent inadvertent contact spread from vaccination sites. Hands must be washed after any touching of the vaccination site area with soap and water or when unavailable with an alcohol-based waterless antiseptic solution.

The employer shall evaluate and direct any fire or EMS activities (including emergency response and training) that may subject employees' vaccination sites to undue pressure (may burst a pustule), rubbing or prolonged immersion in water (may cause tissue breakdown or secondary infection). Many fire or EMS activities, including donning and doffing heavy protective clothing, donning and doffing SCBA, carrying heavy objects (hose or high-rise packs), and leaning against walls while using hose lines at a fire may lead to injury of the vaccination site.

The employer must defer any non-emergency activities, including training, that may complicate vaccine site care and cleanliness. Any vaccination site injury must be reported, immediately evaluated, and if necessary treated by medical personnel. General vaccination site care recommends leaving the site unbandaged. However, for fire and EMS personnel, bandaging may be more appropriate to help reduce spread and accidental infection.

Prior to initiating a small-pox vaccination program, fire departments must develop plans for: site-care stations; personnel to monitor employees' vaccination sites; procedures and training to promote effective bandaging; procedures and training for scrupulous hand washing hygiene; and bio-hazardous waste procedures for disposal of contaminated bandages and dressing, as well as laundering decontamination procedures for clothing (bleach shall not be used for protective clothing), towels, sheets or other cloth materials that have had contact with the site.

The employer must provide employees with occlusive (wound-sealing) dressings,

such as semi-permeable polyurethane dressings (e.g. Opsite® or Tega Derm®). Be aware that occlusive dressings, including non-permeable (hard) or semi-permeable (i.e. polyurethane) coverings, allow for the accumulation of viral contaminated exudate, which requires extra care when removed to prevent viral contamination. Also fluid can accumulate under such dressings, which may increase the maceration of the vaccination site. Occlusive dressings require the vaccination site to first be covered with dry gauze and then applying dressing over the gauze.

Fire fighters are involved in arduous work in wet environments. If the employee becomes wet from their environment or from perspiration, any clothing, bandage, and/or dressing must be removed as soon as practical and replaced with clean clothing and dressings.

The IAFF and our medical advisors will be investigating alternative vaccine administration sites (i.e. lower medial or lateral thigh) for fire fighters and EMS personnel.

Minimizing contacts

The employer is required to develop procedures to minimize contact of newly vaccinated employees with unvaccinated employees and the public.

For employees who have risk factors and accordingly have not been vaccinated, the employer shall ensure that they are physically separated and exempt from activities that pose the likelihood of contact with recently vaccinated employees and potentially infectious materials. Employees with contraindications to vaccination shall not share or use common sleeping space, linens, towels, protective clothing (e.g. protective clothing) and equipment (e.g. SCBA) with employees who have been vaccinated.

- The employer must make provisions for pregnant fire fighters and emergency medical personnel to ensure they are not exposed to vaccinated employees.
- The employer must make provisions for immuno-compromised fire fighters and emergency medical personnel to ensure they are not exposed to vaccinated employees.
- The employer must ensure that non-vaccinated fire fighters and emergency medical personnel with eczema, atopic dermatitis, or acute, chronic or exfoliative skin conditions are not exposed to vaccinated employees.

Recordkeeping

The employer is required to maintain records according to the following schedule:

- **Medical records** (including the employee's name, social security number, smallpox vaccination status, all examinations and evaluations, health care professionals' written opinions, and information provided to the health care professionals) for the duration of employment, plus at least 30 years; and

- **Training records** for three (3) years from the date on which the training occurred. Medical records are confidential and may not be disclosed or reported without the employee's written consent. Medical records are to be available to employees and to anyone having written consent of the employees upon request. Training records are available to the employee or employee representative upon request.

Learn More

The following resources support the information and recommendations presented in this document. These organizations' web sites provide additional information and recommendations on smallpox and the smallpox vaccination. The list provides links to governmental and non-governmental sites dedicated to vaccines, immunization practices, and vaccine safety.

- Centers for Disease Control and Prevention (CDC) - (<http://www.bt.cdc.gov/agent/smallpox/index.asp>)
- National Library of Medicine/National Institutes of Health - (<http://www.nlm.nih.gov/medlineplus/smallpox.html>)
- World Health Organization (WHO) - (<http://www.who.int/emc/diseases/smallpox/factsheet.html>)
- American College of Physicians/American Society of Internal Medicine - (<http://www.acponline.org/bioterro/index.html>)
- Agency for Healthcare Research and Quality - (<http://www.bioterrorism.uab.edu/EIPBA/Smallpox/moreExtInfo.html>)
- American Medical Association (AMA) - (<http://www.ama-assn.org/ama/pub/category/6206.html>)
- Department of Defense (DOD) - (<http://www.vaccines.army.mil>)
- Vaccine Healthcare Center - (<http://www.vhcinfo.org>)
- US Food and Drug Administration (FDA) - (<http://www.fda.gov/cber/products/smawye102502.htm>)
- New England Journal of Medicine: Smallpox and Smallpox Vaccination - (<http://nejm.org/earlyrelease/early.asp>)
- The CDC, NIOSH recommendation, "Interim Recommendations for the Selection and Use of Protective Clothing and Respirators Against Biological Agents" - (<http://www.cdc.gov/niosh/unp-intrecppe.htm>)
- In the wake of the ongoing threat of chemical and biological attack, NFPA is providing free access to its state-of-the-art hazardous materials response standards. Further information on how to obtain these standards from NFPA, as well as other relevant information, can be found at (<http://www.nfpa.org/Codes/CodesandStandards/HazMat/HazMat.asp>)
- The InterAgency Board for Equipment Standardization and InterOperability (IAB) - (<http://www.iab.gov>)

Glossary

A

aerosolized respiratory secretions: Liquid droplets, suspended in air, that arise from coughing or sneezing.

agammaglobulinemia: A pathological condition in which the body forms few or no gamma globulins or antibodies.

angina: A disease marked by brief paroxysmal attacks of chest pain precipitated by deficient oxygenation of the heart muscles.

anthrax: An infectious disease of warm-blooded animals (as cattle and sheep) caused by a spore-forming bacterium (*Bacillus anthracis*), transmissible to humans especially by the handling of infected products (as hair), and characterized by external ulcerating nodules or by lesions in the lungs.

antibodies: Proteins produced by the immune system that act against an infecting agent.

B

bifurcated: Divided into two branches or parts.

botulism: Acute food poisoning caused by botulinum toxin produced in food by a bacterium of the genus *Clostridium* (*C. botulinum*) and characterized by muscle weakness and paralysis, disturbances of vision, swallowing, and speech, and a high mortality rate.

C

cardiomyopathy: Any structural or functional disease of heart muscle that is marked especially by hypertrophy of cardiac muscle, by enlargement of the heart, by rigidity and loss of flexibility of the heart walls, or by narrowing of the ventricles but is not due to a congenital developmental defect, to coronary atherosclerosis, to valve dysfunction, or to hypertension.

CDC: Also known as the Centers for Disease Control and Prevention - A United States government agency that seeks to promote health and quality of life by preventing and controlling disease, injury, and disability.

chickenpox: An acute contagious disease especially of children that is marked by low-grade fever and formation of vesicles and that is caused by a herpesvirus -- called also varicella.

complement fixation: The process of binding serum complement to the product formed by the union of an antibody and the antigen for which it is specific that occurs when complement is added to a mixture (in proper proportion) of such an antibody and antigen.

conjunctiva: The mucous membrane that lines the inner surface of the eyelids and is continued over the forepart of the eyeball.

convalescing: Recovering health and strength gradually after sickness or weakness.

cornea: The transparent part of the coat of the eyeball that covers the iris and pupil and admits light to the interior.

crust: A hardened covering of dried secretions (as blood, plasma, or pus) that forms over a wound.

cytomegalovirus: A herpesvirus that causes cellular enlargement and formation of eosinophilic inclusion bodies especially in the nucleus and that acts as an opportunistic infectious agent in immunosuppressed conditions (as AIDS).

D

delirium: A mental disturbance characterized by confusion, disordered speech, and hallucinations.

deltoid: A large triangular muscle that covers the shoulder joint.

dermatitis: Inflammation of the skin.

distal extremity: A limb located away from the center of the body

DOD: Also known as the U.S. Department of Defense

E

eczema: An inflammatory condition of the skin characterized by redness, itching, and oozing vesicular lesions which become scaly, crusted, or hardened.

edema: An abnormal excess accumulation of serous fluid in connective tissue or in a serous cavity -- called also dropsy.

encephalitis: Inflammation of the brain.

EPA: Environmental Protection Agency

epidemiology: The sum of the factors controlling the presence or absence of a disease or pathogen.

erythema multiforme: A skin disease characterized by papular or vesicular lesions and reddening or discoloration of the skin often in concentric zones about the lesions.

exanthem: An eruptive disease (as measles) or its symptomatic eruption.

exudate: Exuded matter ; especially the material composed of serum, fibrin, and white blood cells that escapes from blood vessels into a superficial lesion or area of inflammation.

F

FDA: Food and Drug Administration

H

hemagglutination: A reaction in which red blood cells suspended in a liquid collect into clumps which occurs especially as a serological response to a specific antibody.

herpes: Any of several inflammatory diseases of the skin caused by herpesviruses and characterized by clusters of vesicles.

I

immunosuppression: Suppression of natural immune responses.

impetigo: An acute contagious staphylococcal or streptococcal skin disease characterized by vesicles, pustules, and yellowish crusts.

incubation period: The period of time between the infection of an individual by a disease-causing agent and the manifestation of the disease it causes.

K

keratitis: Inflammation of the cornea of the eye characterized by burning or smarting, blurring of vision, and sensitiveness to light and caused by infectious or noninfectious agents.

L

lesion: An abnormal change in structure of an organ or part due to injury or disease; especially one that is circumscribed and well defined.

leukemia: An acute or chronic disease of unknown cause in humans and other warm-blooded animals that involves the blood-forming organs, is characterized by an abnormal increase in the number of white blood cells in the tissues of the body with or without a corresponding increase of those in the circulating blood, and is classified according to the type of white blood cell most prominently involved.

lymphadenopathy: Abnormal enlargement of the lymph nodes.

lymphangitis: Inflammation of the lymphatic vessels.

lymphoma: A usually malignant tumor of lymphoid tissue.

M

maceration: Softening of tissue by steeping or soaking so as to separate into constituent elements.

macule: A patch of skin that is altered in color but usually not elevated and that is a characteristic feature of various diseases (as smallpox).

malaise: An indefinite feeling of debility or lack of health often indicative of or accompanying the onset of an illness.

malignancy: Condition tending to produce death or deterioration; especially tending to infiltrate, metastasize, and terminate fatally.

myalgia: Pain in one or more muscles.

myocarditis: Inflammation of the myocardium (the middle muscular layer of the heart wall)

N

necrosis: Death of living tissue.

NFPA: Also known as the National Fire Protection Association - The NFPA seeks to reduce the worldwide burden of fire and other hazards on the quality of life by providing and advocating scientifically-based consensus codes and standards, research, training, and education.

NIOSH: The National Institute for Occupational Safety and Health

O

occlusive dressing: A dressing that seals a wound to protect against infection.

orchitis: Inflammation of a testis.

oropharynx: The part of the pharynx that is below the soft palate and above the epiglottis and is continuous with the mouth.

OSHA: Occupational Safety & Health Administration

osteomyelitis: An infectious inflammatory disease of bone that is often of bacterial origin and is marked by local death and separation of tissue.

P

papule: A small solid usually conical elevation of the skin caused by inflammation, accumulated secretion, or hypertrophy of tissue elements.

pericarditis: Inflammation of the pericardium (the conical sac of serous membrane that encloses the heart and the roots of the great blood vessels)

plague: A virulent contagious febrile disease that is caused by a bacterium of the genus *Yersinia* (*Y. pestis* syn. *Pasteurella pestis*), that occurs in bubonic, pneumonic, and septicemic forms, and that is usually transmitted from rats to humans by the bite of infected fleas (as in bubonic plague) or directly from person to person (as in pneumonic plague).

pock: A pustule in an eruptive disease.

PPE: Personal protective equipment

prodrome: An early symptom of a disease.

psoriasis: A chronic skin disease characterized by circumscribed red patches covered with white scales.

pustule: A small circumscribed elevation of the skin containing pus and having an inflamed base.

Q

quarantine: A restraint on the activities of persons or the transport of goods that is designed to prevent the spread of disease.

S

SCBA: Self-contained breathing apparatus

shingles: An acute viral inflammation of the sensory ganglia of spinal and cranial nerves associated with a vesicular eruption and neuralgic pain and caused by reactivation of the herpesvirus causing chicken pox -- called also herpes zoster, zona, zoster.

systemic: Affecting the body generally.

T

tularemia: An infectious disease especially of wild rabbits, rodents, humans, and some domestic animals that is caused by a bacterium (*Francisella tularensis*), is transmitted especially by the bites of insects, and in humans is marked by symptoms (as fever) of toxemia.

U

umbilicated: Having a small depression that resembles a navel.

V

vaccinee: Person recently vaccinated.

vaccinia: The usually mild systemic reaction of an individual following vaccination against smallpox.

vaccinia necrosum: Ongoing infection of skin with tissue destruction frequently leading to death.

vaccinia virus: The poxvirus that is the causative agent of cowpox and is used for vaccination against smallpox.

varicella: Chicken pox

variola: Any of several virus diseases (as smallpox or cowpox) marked by a pustular eruption.

vesicle: A small abnormal elevation of the outer layer of skin enclosing a watery liquid

viral cellulitis: Diffuse and especially subcutaneous inflammation of connective tissue caused by a virus.

W

WHO: Also known as the World Health Organization - WHO is the United Nations specialized agency for health that seeks the attainment by all peoples of the highest possible level of health. WHO is governed by 192 Member States through the World Health Assembly.

WMD: Weapons of Mass Destruction

World Health Organization: WHO is the United Nations specialized agency for health that seeks the attainment by all peoples of the highest possible level of

health. WHO is governed by 192 Member States through the World Health Assembly.

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