NRT Quick Reference Guide:
Smallpox (Variola major, Variola minor)

For reference, please see "Key References Cited/Used in National Response Team (NRT) Quick Reference Guides (QRGs) for Viral 2012 Revision."
QRGs are intended for Federal On-Scene Coordinators (OSCs) and Remedial Program Managers (RPMs).

<table>
<tr><td>Agent Characteristics</td><td colspan="2">Agent Classification: Biological Type: Virus Family: Poxviridae Genus: Orthopoxvirus
Description: Orthopoxviruses are double-stranded DNA enveloped viruses. There are two clinical forms of orthopoxvirus that causes smallpox; Variola major and Variola minor. Smallpox caused by Variola major is more common & more severe - producing an extensive rash & high fever. Variola major smallpox occurs in three forms in the unvaccinated: 1) "ordinary-type" smallpox producing pronounced pustules & accounts for > 90% of cases; 2) "flat-type" smallpox characterized by severe toxemia and flat, velvety, confluent lesions that do not progress to the pustular stage and; 3) "hemorrhagic-type" smallpox characterized by blood poisoning, and a hemorrhagic rash. Smallpox caused by Variola major in the vaccinated is the "modified-type" smallpox characterized by fewer lesions and is rarely fatal. Smallpox caused by Variola minor is less common & much less severe. This virus is not zoonotic as humans are the only natural host.</td></tr>
<tr><td></td><td>Bio-Safety Level: 4
CDC Category: A
HHS Select Agent: Yes
Incubation Period: 7-19 days
Person-to-Person Transmission: Yes, via inhalation or physical contact with infected bodily fluids (e.g. blood, saliva) smallpox pustules, fluid within the pustules, and crusted scabs are also infective. Smallpox is most contagious within 7-10 days following the onset of rash.
Other Forms of Transmission: Yes, inhalation or physical contact with infected bodily fluids present on contaminated objects (e.g. bedding, clothing).
Infectivity/Lethality: High (only 10-100 virus particles are needed)/Variola major: lethality approx. 30%, Variola minor lethality approx. 1% in unvaccinated & untreated individuals.</td><td>Treatments: There are no proven treatments for smallpox; medical care is generally supportive. Vaccination can prevent or lessen the severity of disease if given within 2-3 days of the initial exposure and decreases symptoms if given within the first week of exposure. Medical care is general supportive accompanied with possible home quarantine.
Persistence/Stability: Orthopoxviruses show a high resistance to drying and are stabilized when associated with dermal crust, serum, blood, and other bodily excretions. Contaminated dust and textiles remain infectious for several years. Purified virus particles from culture are not thought to be as persistent as those from infected individuals. Heat and humidity make the virus less stable.
Primary non-human host: None</td></tr>
<tr><td>Release Scenarios</td><td colspan="2">CAUTION: REAEROSOLIZATION IS A CONCERN FOR ALL RELEASE SCENARIOS
Air/Aerosolization: Smallpox can be aerosolized for a bio-terror event and can be released either in an indoor or outdoor environment. While devices designed to detect aerosolized versions of the orthopoxvirus are available, airborne releases are likely to be identified only after exposed persons become ill. Environmental sampling will be needed to test for evidence of aerosolization of orthopoxvirus & effectiveness of decon.
Surfaces: Stability of the orthopoxvirus is weakened with heating/humidity. In an outdoor release, the orthopoxvirus should be inactive within 24 hours. In an indoor release, the virus can persist for up to 17 weeks on clothing and certain surfaces.
Food/Water: When stored at 4^{0}C, orthopoxviruses have been isolated from contaminated food for up to 14 days and from contaminated storm water for up to 166 days.</td></tr>
<tr><td rowspan="2">Health Effects</td><td>Onset</td><td>Symptoms occur within 7-19 days after exposure.</td></tr>
<tr><td>Signs/Symptoms per Exposure Route</td><td>General: Symptoms include high fever, malaise, aching pains, headaches, and a rash that develops first in the mouth & throat. The rash then covers the body and produces raised bumps. These bumps then become pustules that are raised, round, and firm. The pustules form a crust and then a scab. Scabs fall off leaving scars. Victims are most infectious during the week after appearance of mouth & throat rash & are not contagious when all scabs have fallen off. Smallpox may debilitate the victim to such an extent; victims are susceptible to opportunistic concurrent bacterial infections that have been known to cause residual disabilities (e.g., blindness) even after recovery.</td></tr>
<tr><td>Effect Levels</td><td colspan="2">Specific Effect Levels Are Unknown.
Infectivity: 50% of people exposed to the levels within the infective dose may become infected with smallpox
Infective Dose: 10-100 viruses (naturally occurring smallpox via respiratory tract); otherwise unknown.
Lethality: Variola major, 30% of the unvaccinated/untreated population may die. Variola minor, 1% of the unvaccinated/untreated population may die. Contact the Centers for Disease Control & Prevention (CDC) for more information: (404) 639-3311.</td></tr>
<tr><td rowspan="4">Personnel Safety</td><td>Concerns</td><td>CAUTION: RESPONDERS SHOULD DISCUSS THE ISSUE OF VACCINATION (E.G., FIRST, BOOSTER, ETC.) WITH THEIR HEALTH AND SAFETY OFFICER PRIOR TO COMMENCING WORK BECAUSE PPE, CLEANUP AND DECON ACTIVITIES MAY POSE INFECTION POTENTIAL.
Note: Vaccination does NOT insure immunity.
Check with the Health & Safety Officer regarding PPE, Medical Surveillance, & Health & Safety Plan (HASP). Level of PPE may vary depending upon the incident & site-specific circumstances. The PPE Levels listed are general suggestions only. For decon of workers, use warm soapy water, taking care to avoid abrading the skin.</td></tr>
<tr><td>Medical</td><td>Baseline: Annual physical & respiratory function exams.
Treatments Available: Seek medical attention. Treatment is supportive. Quarantine procedures for infected individuals should be strictly followed.</td></tr>
<tr><td>First Aid</td><td>During Incident: Conduct medical monitoring; use PPE as designated by the HASP; record the PPE levels used; monitor for fever & other signs/symptoms as listed under Health Effects, &, if necessary, ensure medical attention is provided as soon as possible.
Post Incident: Monitor for signs/symptoms &, if necessary, ensure medical attention is provided as soon as possible.</td></tr>
<tr><td>PPE</td><td>CAUTION: UNTIL SAMPLING CONFIRMS THE VIRAL AGENT WON'T OR CAN'T BREAKTHROUGH EITHER A P100 or HEPA FILTER, RESPONDERS SHOULD USE A SELF CONTAINED BREATHING APPARATUS (SCBA) FOR RESPIRATORY PROTECTION
Emergency Response to a Suspected Viral Incident: Possible PPE Levels for emergency responders is based on scenario risks from highest level of protection to least: 1) Pressure-demand Self Contained Breathing Apparatus (SCBA) with Level A protective suit, when: a) Event is uncontrolled, b) Viral agent is airborne or aerosolizable, c) Dissemination method is unknown, d) Performing decon rinsing and washing of workers in Level A protective suits because of an airborne or aerosolizable viral agent. 2) Pressure-demand SCBA with Level B protective suit, when: a) The viral agent is no longer a reaerosolization threat but the viral agent's breakthrough ability for P100 or HEPA filters is not known, b) Response operations may cause a splash hazard. 3) Full-face piece respirator with P100 filter or PAPR with HEPA filters, when sampling confirms the viral agent won't or can't breakthrough the P100 or HEPA filter: 4) Disposable hooded coveralls, gloves, & foot coverings, when there is NO threat of airborne release or re-aerosolization of the viral agent.
Other Workers: PPE recommendations for workers other than emergency responders must be developed in the HASP for the specific scenario. PPE recommendations will vary by job type (e.g., cleanup, decon, etc.), type of exposure (e.g., airborne or surface/liquid/soil hazard), & any other site hazards (e.g., chemical, physical, etc.).</td></tr>
<tr><td>Sampling</td><td colspan="2">Fixed Aerosol Monitoring: Biowatch Program and Automated Detection Systems (ADS) are designed to detect aerosolized versions of the orthopoxvirus.
Portable Aerosol Monitoring: No portable aerosol monitoring equipment or methods are currently employed.</td></tr>
<tr><td></td><td colspan="2">CONCERNS: BEFORE OBTAINING SAMPLES: Identify sample transportation requirements; Contact EPA/HQ-EOC (202-564-3850) for ERLN contract laboratories able to analyze these types of samples; Clearly identify & coordinate with the laboratory to be used since most labs cannot analyze all types of media (e.g., wipes, swabs, filters, etc.); Coordinate with the sample disposal facility for acceptance criteria (i.e., sample decon requirements); Coordinate with investigative units (EPA-CID & FBI) to ensure sample chain-of-custody is maintained between the groups. Note: Sampling techniques, analytical equipment and detection levels will be site-specific & depend on: 1) characteristics of the agent; 2) type of contaminated surfaces (e.g., porous v. nonporous); 3) response phase & purpose of sampling; 4) collection and storage methods applied; 5) transportation regulations; 6) laboratory sample acceptance criteria and; 7) decon requirements of sample waste disposal facility.</td></tr>
</table>

	CAUTION: VERIFICATION OF ALL HEPA EQUIPMENT EFFICIENCY IS REQUIRED **Sampling Location Plans:** If the initial point of contamination is known, start with an area thought to be free of contamination & work in concentric circles towards the initial point of contamination. Be concerned about likely contaminated areas (e.g., elevator buttons, mail, corners of hallways, baseboards, light switches, door knobs) due to foot traffic or ventilation systems. Based on site characteristics & laboratory capacity, a sampling plan may be judgmental, probabilistic, or a combination thereof.
	Consult EPA/HQ-EOC at 202-564-3850 for Environmental Response Laboratory Network (a.k.a. ERLN laboratory) personnel who can explain sampling procedure that is compatible with current analytical procedure. **Types of Samples:** Air, water, soils, surfaces, & environmental. **Air:** Collect air samples with gel filter or impinger. Refer to the manufacturer's aseptic sampling methods, flow rates, & sampling times. Ensure that the appropriate pump is used for the selected sampling method. **Water**: Viruses may persist in water; therefore, any consumable liquid should be sampled. If the consumable liquid is chlorinated, the chlorine needs to be neutralized immediately with a sodium thiosulfate or other neutralizer at the concentration specified by the analytical laboratory prior to shipment. As chlorine levels can vary substantially throughout a drinking water system, it is not always appropriate to assume that a sample is chlorinated based solely on a description of the water treatment processes in use. **Soil:** For the localized areas where soil deposition of the agent is suspected to have occurred (i.e., aerosol or liquid droplets), a surface soil sample from a depth of less than 1 inch (2.54 cm) should be obtained from non-vegetated area. **Surfaces: 1)** Wipe & Swab Sampling (for non-porous surfaces): Sterile macrofoam swabs moistened with 1X phosphate-buffered saline supplemented with 0.01% Tween-20 (PBST). If this solution is not available, use sterile de-ionized water (DI). Do NOT use dry wipes or swabs. **2)** HEPA Vacuum Sampling (for both porous & non-porous surfaces): collect samples in a HEPA sock designed to fit into an inlet nozzle of a HEPA vacuum cleaner. Good for screening & determining the extent & location of contamination in large areas. **A site-specific sampling plan should be reviewed & approved by appropriate Subject Matter Experts &/or through ICS channels.**
	Sample Packaging & Shipping: The packaging & shipping of samples are subject to strict regulations established by DOT, CDC, USPS, OSHA, & IATA. Contact the sample-receiving laboratory to determine if they have additional packaging, shipping or labeling requirements. HF samples should be placed in an air-tight container & kept at temperatures of 40-50^{0}F (4-10^{0}C).
	CAUTION: Many labs may not be able to perform analysis on all matrices (e.g., wipes & soil). The goal of laboratory analysis for environmental sampling purposes is to determine if viable Variola major or Variola minor virus is present in the sample. NOTE: The selected laboratory may use a tiered approach. If a tiered approach is used, the initial analysis may only determine if select/particular components of the virus are present in the sample (e.g., presence or absence). It may take additional time (***under ideal conditions may take up to weeks depending on the laboratory***) to determine if the virus is viable & still able to cause adverse effects. **Laboratory Information:** Contact EPA/HQ-EOC (202-564-3850) for contract laboratories able to analyze these types of samples.
Decontamination/Cleanup	**CAUTION: VERIFICATION OF ALL HEPA EQUIPMENT EFFICIENCY IS REQUIRED** **Decon/Cleanup Planning:** Site-specific decon/cleanup plan should be developed & approved by all necessary organizations/SMEs via ICS channels. Responders should develop a plan that takes into account: **1)** Nature of contamination including physical properties, how it entered the facility, etc.; **2)** Extent of contamination, including the amount & possible pathways that have or could have spread the virus. It is advisable to isolate the contaminated area; & **3)** Objectives of decon, including decon of critical items for re-use & the treatment, removal, or packaging of other items for disposal. **Note:** Crisis exemptions from EPA's Office of Pesticide Programs might be necessary depending on decontaminating agents used. **WARNING: DECON SOLUTIONS SHOULD NOT BE DEPLOYED AS A SPRAY.** **Decon Methods:** Decon decisions will be site & situation specific but due to re-aerosolization concerns, ***under NO circumstances should a non-HEPA vacuum cleaner or a broom be used.*** EPA's National Decon Team, call the NRT pager at 800-329-1841 can provide specific decontamination parameters & the requirements for using readily available commercial items such as household bleach. For large areas, low-tech cleanup methods most likely won't be used – rather, widespread fumigation would be the most expedient & cost effective method selected. For small areas of contamination, discreet area decon methods would typically proceed as follows: allow aerosols to settle & wear protective clothing; gently cover any contaminated areas with paper towel(s) (overlapping each other if necessary) & apply decon solutions. This virus can be inactivated by the following decon solutions: **1)** pH-amended bleach solution (i.e., 1 part household bleach, 1 part vinegar & 8 parts water); **2)** a 40-70% aqueous solution of ethanol or isopropyl alcohol, **3)** benzalkonium chloride, **4)** ortho-phenylphenol, **5)** iodophor, & **6)** a 5% aqueous solution of a phenolic germicidal detergent (e.g., industrial strength Lysol®). Apply the decon solution by starting at the perimeter & wet towards the center of the contaminated area. Ensure sufficient contact time (i.e., 60 minutes) is provided & ensure the paper towel is kept "sopping" wet during this time. Remove the paper towel(s) then wipe up the residual dampness/drops of disinfectant until surface is dry. Reapply disinfectant to the bare surface & wipe up again with more paper towel(s) then let surface air-dry. All contaminated decon materials (e.g., paper towels, etc.) should be appropriately treated & discarded as bio-hazardous waste. **Verification of Decon:** Site and situation specific. Please contact ERT (732-321-6660) and/or NDT (800-329-1841) for further assistance.
Waste Disposal	**CAUTION:** Hazardous waste transportation & disposal are regulated federally; however more stringent regulations may exist under state authority. These regulations differ from state-to-state. Detailed state regulations can be found at www.envcap.org.
	Waste Disposal Planning: Waste generated from assessment & cleanup activities should be incinerated, autoclaved, chemically disinfected, or fumigated & then tested to be sure the agent(s) were inactivated. Waste disposal for agent-contaminated wastes generated from the decontamination & disposal activities will be problematic. Landfills willing to take these wastes may be limited & incineration may be prohibitively expensive or impractical. All waste disposal options should be investigated as early into the response process as possible. Transportation of the agent contaminated wastes from the site to the landfill or incinerator may be problematic as well. First, agreements must be reached between the waste sender & acceptor BEFORE transport, followed by timely public notification of the transport & disposal phases. Transportation of hazardous waste may cross several states and localities, which may exceed federal regulations. Requirements for transporting hazardous materials, & procedure for exemption, are specified in http://www.fmcsa.dot.gov/safety-security/hazmat/complyhmregs.htm#hmp. The U.S. EPA has developed a web-based Incident Waste Management Planning & Response Tool which contains guidance related to waste transportation, contact information for potential treatment, disposal facilities, & state regulatory offices, packaging guidance to minimize risk to workers, & guidance to minimize the potential for contaminating the treatment or disposal facility. Access to the EPA's web based disposal tool requires pre-registration (http://www2.ergweb.com/bdrtool/login.asp).