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Mpox Information for Water Professionals

Prepared by the Waterborne Infectious Disease Outbreak Control (WIDOC) Focus Group of the Disinfection and Public Health Community (DPHC) of the Water Environment Federation (WEF)

Background: Between May 7, 2022 and May 26, 2023, more than 87,000 human mpox cases and 140 related deaths have been reported across 111 countries in Europe, the Americas, the Middle East, and Australia (WHO 2023c), where the virus is not normally found. The outbreak appears to have a pattern of spread that does not mirror past outbreaks outside of Africa, almost all of which have been related to importation via flights from Africa or exposure to infected exotic pets. As of June 6, 2023, the U.S. Centers for Disease Control and Prevention (CDC) had confirmed a total of 30,450 cases and 42 deaths in the U.S. (US CDC 2023a) and the Public Health Agency of Canada (PHAC) had confirmed a total of 1,496 cases in Canada (PHAC 2023). On July 23, 2022 the World Health Organization (WHO) Director General issued a statement declaring that the global mpox outbreak represents a public health emergency of international concern (PHEIC) (WHO 2022). The U.S. Department of Health and Human Services declared the U.S. mpox outbreak to be a public health emergency on August 4, 2022 (Philpott et al. 2022). On May 11, 2023, WHO declared that the multi-country mpox outbreak was no longer a PHEIC (WHO 2023b). The mpox outbreak is still considered a public health emergency in the U.S.

Below is an updated summary of what the scientific community knows and does not know about the mpox virus, previously known as monkeypox virus and sometimes referred to as "MPXV". It is important to note that the information on this virus continues to evolve daily. The WIDOC Focus Group is continuing to monitor the evolving mpox situation and virus information and will provide updates as warranted.

Mpox quick facts

- Mpox is endemic to central and west Africa, but since May 2022 has spread to at least 111 countries outside of the endemic area. Infections have not followed the transmission pattern seen in the past (acquiring an infection while travelling to Africa or through interacting with an infected exotic pet).
- Mpox was first identified in 1958 in monkeys and not identified in humans until the 1970s.
- Mpox is an enveloped DNA virus most closely related to other pox viruses, such as smallpox and vaccinia virus, which is used to make the smallpox vaccine.
- Mpox is a zoonotic disease. Zoonotic infections are caused by microorganisms that transmit diseases between humans and animals.
- The smallpox vaccine is effective against mpox but not widely available. Since the eradication of the smallpox in the 1980s, the administration of the smallpox vaccine to the general population has ceased. Experts believe that the recent increase in mpox cases may be related to waning smallpox vaccine immunity in the global population.

- Two mpox vaccines (ACAM2000 and JYNNEOS) are available and treatments have been approved by the U.S. Food and Drug Administration.
- Transmission is context- and setting-specific and evaluated based on available research on mpox or related viruses. It can be thought of as falling into three categories:

1. **Proven transmission to date:**
   - Direct skin-to-skin contact with body fluids, pustules, or lesions of a positive case;
   - Contaminated surfaces (*i.e.,* fomites) such as bedding;
   - Close, prolonged respiratory contact with cases in households and health care; and
   - Contact with known zoonotic animals such as infected rodents and their wastes.

2. **Rare/infrequent but documented transmission to date:**
   - Airborne transmission without direct contact; and
   - Needle stick injury transmission in health care.

3. **Unproven and undocumented, but plausible, transmission to date:**
   - Human fecal wastes, wastewaters, and biosolids; and
   - Environmental waters.

- Asymptomatic transmission of mpox virus has not been documented, but the related smallpox virus can be transmitted by asymptomatic cases.
- Since close physical contact with infected persons can spread mpox, any person - irrespective of gender or sexual orientation - can acquire and spread mpox.
- The incubation period is typically 6 to 13 days but can range from 5 to 21 days (WHO 2023a).
- Symptoms include fever, muscle aches/pains, fatigue, headache, skin rash/lesions/pustules and swollen lymph nodes. Symptoms typically persist for 2 to 4 weeks.
- The onset of a rash is considered the start of the infectious period.
- The mpox virus outbreak emphasizes the importance of ongoing and proactive emerging, zoonotic disease surveillance and collaboration between animal and human health authorities in the One Water, One Health framework (O'Brien and Xagoraraki 2019).

Mpox information relevant to water sector workers

Relevant detections of mpox virus or DNA

- Infective mpox virus
  - Has been isolated from surfaces and dust (but not the air or water) in an infected patient's hospital room in Singapore (Marimuthu et al. 2023) and India;
  - Has been isolated from pustules, skin lesions, and semen in Germany (Noe et al. 2023), Italy (Lapa et al. 2022), and Spain (Peiro-Mestres et al. 2022);
  - Has been isolated from rectal swabs of asymptomatic mpox cases (De Baetselier et al. 2022), suggesting that it should be expected in human feces, although there are no reports of positive detections in human feces yet;

- Is shed in infected animal feces;
- Has not been isolated from human urine, although infective *smallpox* virus was isolated from human urine in the 1970s;
- Has been shown to be stable in wastewater after being added as a spike (at an initial concentration of 10^5 plaque forming units/mL), with a half-life of 5.7 days (95% confidence interval: 4.6 to 8.1 days) (Yinda et al. 2023); and
- To date, has **not** been detected in unspiked wastewater or biosolids.

- Mpox DNA
  - Has been detected in the urine, feces, saliva, skin lesions, and semen of human cases in the United Kingdom (Adler and Taggart 2022), France (Wurtzer et al. 2022), Spain (Peiro-Mestres et al. 2022), Germany (Noe et al. 2023), and Italy (Antinori et al. 2022). DNA shedding in feces in positive cases has been reported to last for more than 16 days;
  - Has been isolated from air samples in Spain (Hernaez et al. 2023) and the UK (Gould et al. 2022);
  - Has been detected in wastewater in many locations in the US, as illustrated by data from the National Wastewater Surveillance System and the WastewaterSCAN Network; and
  - Detection of DNA does not necessarily mean that the infective virus is present.

Inactivation of mpox virus and worker protection

- Like other large, enveloped viruses, mpox virus is expected to have less intrinsic resistance to inactivation by chemical and physical modes of disinfection compared to non-enveloped viruses. Its relative vaccinia virus was inactivated by 40% ethyl alcohol, 30% isopropyl alcohol, 100 ppm benzalkonium chloride, or 200 ppm sodium hypochlorite after 10 minutes of contact time at room temperature on non-porous surfaces. The U.S. Environmental Protection Agency has designated mpox virus a Tier 1, easy-to-disinfect virus, and has updated its list of registered disinfectants (US EPA 2023).
- Current wastewater and drinking water treatment and monitoring practices are expected to be sufficient to protect public and environmental health.
- The worker safety recommendations of the WEF Blue-Ribbon Panel (WEF 2020) remain relevant and protective for wastewater workers against mpox virus as well as other infective agents in wastewater. These recommendations are consistent with the CDC's guidance for reducing health risks to workers handling human waste or sewage (US CDC 2023b).
- Household or workplace items that come into contact with confirmed or suspected mpox case bodily fluids, skin, or lesions should be laundered at hot temperatures with bleach and detergent. Laundering of soiled coveralls at utilities may require additional considerations in compliance with ASTM or industry standards if coveralls are flame, thermal and/or arc resistant. [1]

[1] CDC recommends laundering smallpox-contaminated household items at no less than 71°C (160°F) with detergents and bleach to achieve inactivation of any infective viruses present. However, most household water heaters are set at between 50°C to 55°C (120°F to 130°F). If washing machines do not have a heating element, water heaters must be adjusted to achieve

- CDC's Advisory Committee on Immunization Practices (ACIP) (Rao et al. 2022) has identified research laboratory personnel working with orthopoxviruses, clinical laboratory personnel performing diagnostic testing for orthopoxviruses, and orthopoxvirus and health care worker response teams designated by appropriate authorities as workers with high risk of exposure to mpox. Risk of exposure for wastewater workers is expected to be low (unless otherwise determined by Job Safety Assessments), thus mitigating the need for industry wide ACAM2000 or JYNNEOS vaccination campaigns.
- Utilities and municipalities overseeing collection systems should contact hospitals and clinics who may treat positive mpox cases if patient waste is being treated as Category A waste (similar to Ebola) as a precautionary measure to inform the utility's job safety assessment.

Other considerations

- Wastewater-based surveillance (WBS) for mpox provided valuable information during the US mpox outbreak, with positive wastewater results "often associated with geographic areas where cases had been reported" and testing being "useful as an early warning signal" (McQuiston 2023). However, ongoing research is warranted to understand mpox virus shedding into wastewater and its persistence in environmental matrices (Tiwari et al. 2023). Utilities and water resource recovery facilities collaborating on WBS efforts with health authorities and researchers are encouraged to continue providing samples for mpox virus analysis if they feel comfortable doing so.
- While anyone can be infected with mpox, the CDC reports that infections during the 2022 outbreak were "primarily spread by sexual contact among gay, bisexual, and other men who have sex with men" (McQuiston 2023). It is therefore important that any communications on the topic address equity and minimize stigma.

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