

# THE WATER PROFESSIONAL'S GUIDE TO COVID-19

## **WEF Disinfection and Public Health Committee's (DPHC) Waterborne Infectious Disease Outbreak Control (WIDOC) Working Group**

### **Editor's Note**

The information presented here is a summary of current knowledge about this emerging viral pathogen. The state of knowledge will evolve as additional investigation and research is conducted, continue to monitor reputable sources.

**A** new coronavirus was identified as the cause of an outbreak of respiratory illness, referred to as COVID-19. It was first detected in Wuhan, China, on Dec. 12, 2019. Because this disease has spread worldwide, it is important that water sector professionals keep informed on the attributions of this virus and any measures needed to protect both workers and public health, in general.

### **Extent of the COVID-19 Outbreak**

Based on the sharp increase in number of COVID-19 infections, on Jan. 30, 2020, the World Health Organization (WHO) declared the current outbreak to be a public health emergency of international concern.

On March 4, 2020, the World Health Organization reported 93,090 cases globally and 3,198 deaths in 66 countries worldwide, with the vast majority (80,422 cases and 2,984 deaths) in China, according to WHO's Situation Report – 44.

The U.S. reported its first confirmed case of person-to-person spread with this virus on Jan. 30, 2020. As of March 5, 2020, there were 163 confirmed cases in the U.S. across 18 states, as well as 11 deaths, according to news reports.

In Canada, 33 cases of COVID-19 had been confirmed in three provinces as of March 5, 2020, according to the Public Health Agency of Canada. Canadian case numbers are being updated daily.

### **Have We Seen This Virus Before? What Do We Know About Its Origin?**

The virus, technically named SARS-CoV-2, is a newly identified virus strain, but it is the seventh coronavirus known to infect humans. The resulting illness is referred to as COVID-19. This virus is in the same coronavirus family as severe acute respiratory syndrome coronavirus (SARS-CoV or SARS) and Middle East respiratory syndrome coronavirus (MERS-CoV or MERS), which caused the two previous outbreaks in 2003 (SARS) and 2012 (MERS).

Since SARS and MERS are from the same family of coronaviruses, they have similar physical and biochemical properties and comparable transmission routes as COVID-19. In the absence of COVID-19 specific data, we rely on SARS, MERS, and coronavirus surrogate data to extrapolate, assess, and manage risk. See a comparison of COVID-19 to SARS and MERS on p. 28.

In addition to the seven coronaviruses known to infect humans, many other coronaviruses are known to infect animals. Viruses that infect animals do not normally infect humans and vice versa, but mutations in the viral genetic material can occur naturally and lead to animal-to-person spread, formally known as zoonotic transmission.

Initially, many of the patients in the outbreak in Wuhan reportedly had some link to a large seafood and animal market suggesting animal-to-person









virus can survive in wastewater from hours to days (Casanova *et al.*, 2019 and Wang *et al.*, 2005b). In 2003, research on SARS had suggested that wastewater was implicated in the infection of a cluster of cases in the Amoy Gardens apartment block in Hong Kong (Hung, 2003). A report this year from CNN indicated possible COVID-19 transmission through wastewater pipes in a building in Hong Kong, but this remains to be confirmed.

However, previous work also highlights that SARS can readily be disinfected when chlorine dosing produces a free chlorine residual between 0.2 and 0.5 mg/L for municipal wastewater (Wang

*et al.*, 2005a). While Ebola virus is different, it is reassuring that the article, “Persistence of Ebola Virus in Sterilized Wastewater,” (Bibby, 2015) similarly showed that no virus was recovered at doses of 5 and 10 mg/L of chlorine and a 3.5 log reduction was achieved in the presence of free chlorine residual of 0.16 mg/L for 20 seconds.

These results imply that standard municipal wastewater system disinfection and hyper (or shock) chlorination practices may be sufficient to control the virus provided utilities monitor free available chlorine during treatment to ensure it has not been depleted.

## Signs and Symptoms of Coronavirus Infection

Three main symptoms are being highlighted by the CDC: cough, fever and shortness of breath.

One distinguishing feature of this Coronavirus infection, named COVID-19, is dyspnoea or shortness of breath, which has been reported in more than half of patients [55%]. It can take anywhere from 2 to 14 days for symptoms to develop, according to the U.S. Centers for Disease Control and Prevention.

A study published by the *Lancet* reported that as of Jan. 2, 2020, included other less common symptoms at onset of illness, such as fever [98%], cough [76%], myalgia, or fatigue [44%], sputum production [28%], headache [8%], haemoptysis (coughing up blood) [5%], and diarrhea [3%] (Huang *et al.*, 2020).

### Treatment or Vaccine for the Coronavirus?

At press time, there currently were neither vaccines nor direct treatments against the novel Coronavirus. Upon admission to hospitals patients are provided with supportive therapies to help with symptom relief until the immune system can fight the virus. Development of vaccines may be complicated by COVID-19’s reinfection rate which is as high as 14% in China but has only occurred once outside of China in Osaka, Japan.

### How Can I Stay Healthy?

While the CDC reports that the immediate risk of this new virus to the American public is believed to be low at this time, they recommend that everyone do their part to help us respond to this emerging public health threat. Because people of all ages have been infected by COVID-19, the WHO advises everyone to take proper infection control precautions. The best way to prevent infection is to avoid being exposed to this virus. However, as a reminder, CDC always recommends everyday preventive actions to help prevent the spread of respiratory viruses, including:

- Stay informed.
- Wash your hands often with soap and water for at least 20 seconds.
- If soap and water are not available, use an alcohol-based hand sanitizer with at least 60% alcohol content.
- Avoid touching your eyes, nose, and mouth with unwashed hands.
- Avoid close contact with people who are sick.
- Stay home when you are sick.
- Cover your cough or sneeze (ideally with a disposable tissue).
- Clean and disinfect frequently touched objects and surfaces.
- Do not place your personal belongings on the floor or on surfaces that may be contaminated.

### What Should You Do If You Think You Are Infected?

If you feel sick with fever, cough, have difficulty breathing, and have traveled to China or were in close contact with someone with COVID-19 in the 14 days before you began to feel sick, seek medical care immediately.

Before you go to a doctor’s office or emergency room, call ahead and tell them about your recent travel and your symptoms.

## What Utilities Can Do

### PROCESS

- **Business as usual**
  - **Current disinfection practices are expected to be sufficient**
  - **Monitoring plant performance (e.g., free chlorine, fecal indicator bacteria)**
- **Supply chain management is crucial (e.g., parts, equipment, personal protective equipment (PPE), chemicals).**

### Wastewater Treatment and COVID-19

Disinfection systems at water resource recovery facilities (WRRFs) and the associated regulatory requirements were developed to be protective of a broad spectrum of potential pathogens. The recent coronavirus serves as another example of the importance of this infrastructure for protecting public health.

On Feb. 5, 2020, the U.S. Occupational Safety and Health Administration (OSHA) released its new wastewater worker guidance stating that current disinfection conditions in WRRFs, such as oxidation with hypochlorite or peracetic acid, and inactivation by ultraviolet irradiation, are expected to be sufficient to protect wastewater workers and public health. The recommendation is based on coronavirus disinfection data from healthcare settings and corresponds with OSHA's position on the susceptibility of coronaviruses to disinfection. It also aligns with what we know about CDC's hierarchy of decreasing levels of resistance of microorganisms to disinfection shown in Figure 1 (p. 30).

These recommendations are likely to be

**Current disinfection conditions in WRRFs, such as oxidation with hypochlorite or peracetic acid, and inactivation by ultraviolet irradiation, are expected to be sufficient to protect wastewater workers and public health.**

broadly applicable, although more research may be warranted for disinfectants such as peracetic acid (Worley-Morse, 2019) and combined chlorine (chloramines), where coronavirus specific data is lacking or evidence suggests higher bacterial susceptibility to disinfection compared to viruses (Worley-Morse, 2019). Although coronaviruses have not been tested, peracetic acid has been found to have some efficacy against some non-enveloped viruses (e.g., Norovirus) that are known to be more resistant than enveloped viruses based on the CDC hierarchy of microorganisms resistance to disinfection (Figure 1).

Chlorine is extensively used for wastewater disinfection due to its effectiveness, low cost, and ease of application. It typically reacts with ammonia present in wastewater to form combined chlorine (chloramines), which behaves differently than free chlorine during disinfection. Thus, it is important for each facility to understand the chlorine species that are present and their relative abundance within the disinfection process. We would also expect some virus inactivation in primary and secondary treatment. A meta-analysis by Sano *et al.* published in 2016 showed that conventional activated sludge systems can achieve 0.87 and 1.48 log removals for rotavirus and norovirus GI, respectively. We would expect higher removals for enveloped viruses. Additional research is needed to provide reassurance on the effectiveness of wastewater disinfection and treatment processes, specifically against coronaviruses and at lower doses and contact times.

### Is This Virus an Occupational Health Concern to Wastewater System Workers?

Wastewater treatment and collection system workers are commonly exposed to untreated wastewater that contains disease-causing organisms that could result in an infection. While the risk of infection may increase during some outbreaks (Haas *et al.*, 2017), thus requiring additional protective measures for workers, this is not the case for COVID-19, based on the current OSHA guidance at press time. Access this guidance at [www.osha.gov/SLTC/covid-19/controlprevention.html#solidwaste](http://www.osha.gov/SLTC/covid-19/controlprevention.html#solidwaste).

These findings are bolstered by what we know about disinfection and persistence of coronaviruses and their surrogates in the environment (Rabenau *et al.*, 2005).

WRRF operations should ensure workers follow routine practices to prevent exposure to wastewater, including using the engineering and administrative controls, safe work practices, and PPE normally required for work tasks when handling untreated wastewater. It is important to communicate that

proper PPE use and sound hygiene practices are protective against coronaviruses and other waterborne infectious viruses. It is also important for utilities to reexamine their standard operating procedures and hazard assessments to evaluate the protections in place against infectious agents found in wastewater and collection systems. Research on the survival and infectivity of COVID-19 virus in wastewater, and on the efficacy of different wastewater disinfection options, including chlorination, peracetic acid, and UV, are needed to better assess the risk to both public and occupational health.

For information specific to protection of workers during infectious disease outbreaks, OSHA has a page dedicated to COVID-19 occupational health protection that highlights resources for workers and employers on the evolving situation. It also has resources for housekeeping practices — [www.osha.gov/SLTC/etools/hospital/housekeeping/housekeeping.html#Disinfectants](http://www.osha.gov/SLTC/etools/hospital/housekeeping/housekeeping.html#Disinfectants) — that can be helpful and resources for protecting workers during pandemics and apply to office workers, too. Access this guidance at [www.osha.gov/Publications/OSHA-FS-3747.pdf](http://www.osha.gov/Publications/OSHA-FS-3747.pdf).

### Should We Disinfect Surfaces That May Have Come in Contact with Untreated Wastewater?

For contaminated surfaces to play a role in transmission, respiratory pathogens must be shed into the environment, survive on the surface, be transferred to hands or other objects at concentrations high enough to cause infection (*i.e.*, at an infectious dose) and be transferred to the mouth, nose, or eyes at an infectious dose. Transmission can be interrupted at any of these steps. Therefore, disinfection of PPE, surfaces, and equipment that comes in contact with untreated wastewater can lower risk of infection.

Studies have shown that SARS virus can be inactivated fairly effectively (greater than or equal to 4 log reductions) using common household sanitizers or hand rubs provided recommended contact time and concentrations are used. Similar results were found when investigating common household disinfectants to reduce coronavirus surrogate concentrations (Dellanno *et al.*, 2009). This is consistent with OSHA's statement on coronaviruses being highly susceptible to inactivation by many commonly used disinfectants. The American Chemistry Council's Center for Biocide Chemistries compiled a list of products that have been pre-approved by the U.S. Environmental Protection Agency (EPA) for use against emerging enveloped viral pathogens and can be used during this outbreak.

**COVID-19**  
CORONAVIRUS DISEASE

**SYMPTOMS OF CORONAVIRUS DISEASE 2019**

**Patients with COVID-19 have experienced mild to severe respiratory illness.**

**Symptoms\* can include**

- FEVER**
- COUGH**
- SHORTNESS OF BREATH**

*\*Symptoms may appear 2-14 days after exposure.*

**Seek medical advice if you develop symptoms, and have been in close contact with a person known to have COVID-19 or if you live in or have recently been in an area with ongoing spread of COVID-19.**

**CDC**

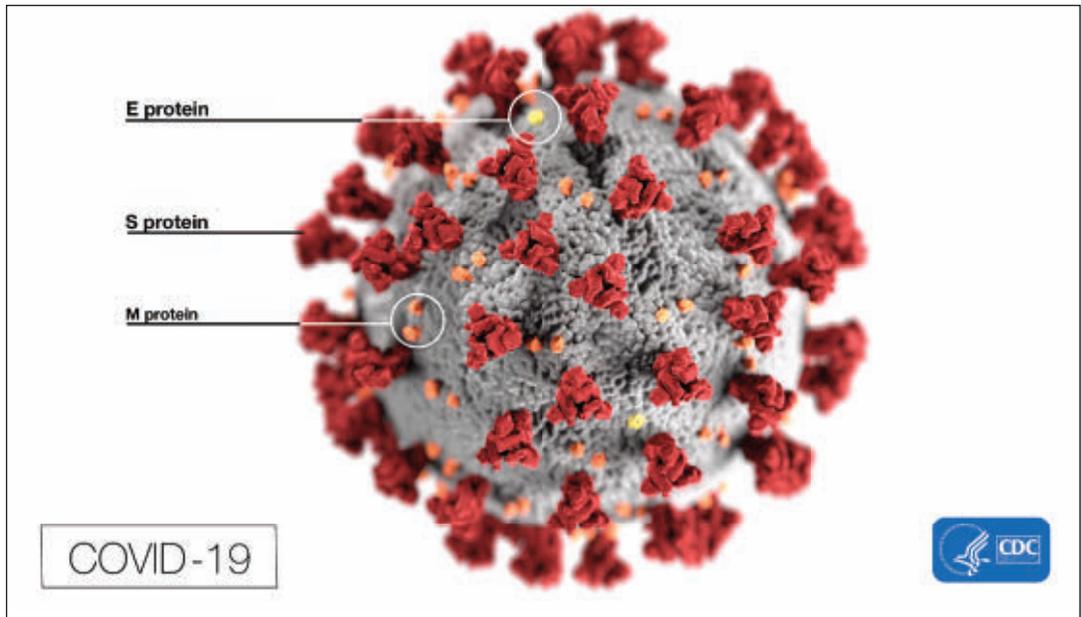
For more information: [www.cdc.gov/COVID19-symptoms](http://www.cdc.gov/COVID19-symptoms)

This product list — available at [www.americanchemistry.com/Novel-Coronavirus-Fighting-Products-List.pdf](http://www.americanchemistry.com/Novel-Coronavirus-Fighting-Products-List.pdf) — is not exhaustive but can be used by business owners, health professionals, and the public to identify products suitable for COVID-19 infection control. Before recommending products and disinfectants to wastewater workers, it is important for utilities to ensure supply chains are proactively managed and the products are available for use. The additional research on COVID-19 quantitative occurrence,

## What Utilities Can Do

### FACILITIES AND COLLECTION SYSTEMS

- Examine administrative controls (e.g., safe work plans, hazard assessments and registries, and risk assessments)
- Identify areas of high concerns - e.g., high splash activities
- Identify critical staff and their backups
- Review engineering controls



survival, inactivation rates, and dose-response could support quantitative microbial risk assessments. 

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