Factsheet

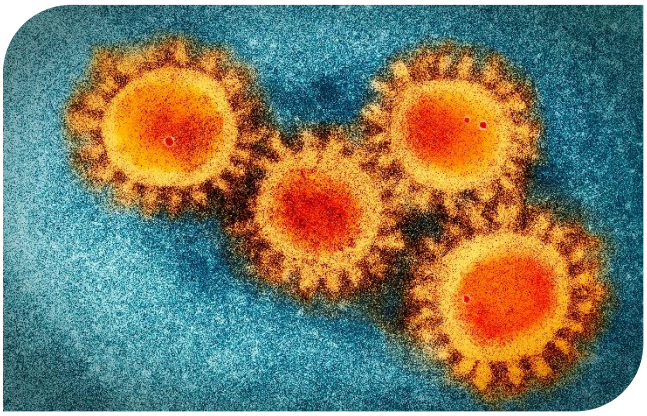
SARS-CoV-2 - Water and Sanitation

Water Research AUSTRALIA

This information sheet synthesises information currently available on SARS-CoV-2 [previously known as novel coronavirus (2019-nCOV)] — what is known about the virus, similar viruses, the related disease (COVID-19), and the management of viruses in terms of water and sanitation systems.

What is Coronavirus (CoV)?

Coronaviruses are a large and diverse family of enveloped[i] RNA[ii] viruses. These lipid-enveloped CoV viruses are generally considered more fragile than other viruses (both environmentally, and to disinfection), however are known to cause illness of variable severity in humans, including the common cold, severe acute respiratory syndrome (SARS-CoV), and Middle East Respiratory Syndrome (MERS-CoV). The name 'corona' comes from their round appearance and the spikes on their surface that can be likened to a solar corona, as shown in the image below.



The term HCoV is used to represent human coronaviruses, of which there are seven types currently described. Although most human coronavirus infections cause mild symptoms and may even go unnoticed[15], two coronaviruses: SARS-CoV[iii], and MERS-CoV[iv], emerged in 2002 and 2012, respectively, and resulted in epidemics, that infected thousands and caused hundreds of deaths.

Quick Facts

- Virus is enveloped, single stranded RNA
- Chlorine typically inactivates CoV[4,9]
- The virus can cause pneumonia[3,7]
- In many cases disease (COVID-19) is mild[15]

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Prior to late 2019 there were just six types of HCoV described. However, a cluster of patients suffering from pneumonia (a lung infection) was identified in the city of Wuhan, Hubei Province, China, on 21 December 2019. Testing of fluid from a patient's lungs resulted in the identification of the 7th HCoV on 3 January 2020. The patient was suffering from a disease now named COVID-19 and the virus causing the disease was formally named SARS-CoV-2 on 11 February 2020[8]. Whilst the initial cluster was believed to be spread from animals to humans, direct human to human transmission is now spreading the virus globally. As with other HCoV types, the principal transmission route is via droplets contaminated with the virus. These are spread via coughs, sneezes and nasal secretions that can then either be directly inhaled by a person nearby or transferred via indirect contact via surfaces that have become contaminated. Whilst it has yet to be studied in detail, the SARS-CoV-2 is likely to have similar properties to the SARS-COV due to its close genetic similarity[16].

SARS-CoV-2 is transmitted from person-to-person via the respiratory system through sneezing, coughing and secretions, both directly and indirectly via contaminated surfaces.

Like most infections, people with underlying medical conditions and the elderly are more susceptible.

SARS-CoV-2 and implications for water and sanitation systems and workers

Consideration of water and sanitation systems is not a first priority when seeking to monitor and manage the spread of HCoV since the viruses are not typically waterborne. However, there are factors that need to be understood where the spread of the SARS-CoV-2 might have implications for the continuity of supply.

Management of water and sanitation systems should remain business as usual.

[i] The term 'enveloped' refers to the membrane envelope around the surface of the virus. Some viruses are 'naked' and have no such membrane envelope. This feature is relevant to understanding their resistance to disinfection as well as their environmental persistence and transmission.

[ii] The term 'RNA' is shorthand for ribonucleic acid which makes up their genome. Some viruses have DNA, or deoxyribonucleic acid. This is relevant to their resistance to UV disinfection.

[iii] SARS: Severe Acute Respiratory Syndrome

[iv] MERS: Middle East Respiratory Syndrome

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Working around wastewater

Some coronaviruses can potentially survive in the gastrointestinal tract and be spread by the 'faecal-oral' route or via inhalation of contaminated wastewater droplets. There have not been reports of faecal-oral transmission of COVID-19 to date[12]. Two studies have reported detection of SARS-CoV-2 fragments in faecal matter of COVID-19 patients[13,14]. Whilst plausible, because it's newly discovered, it is not yet certain how well the virus is able to survive in water and wastewater. However, nasal secretions are found in wastewater (e.g. due to flushing of tissues) and most likely SARS-CoV-2 will enter wastewater systems. Furthermore, the most similar virus tested, SARS-CoV, was shown to be present in wastewater and to persist in faeces, urine, water and wastewater for periods up to 2 days at 20°C, at least 14 days at 4°C, and survive for 4 days in diarrheal stool samples with an alkaline pH at room temperature[9,11].

Based on this, it is possible that SARS-CoV-2 may be present in wastewater where COVID-19 infections are present. Importantly, the same is true for a wide variety of pathogens, such as other viruses, bacteria and protozoa. The controls already in place to protect persons working around wastewater are based on keeping workers safe from much more readily transmissible and established faecal-oral pathogens (such as norovirus, adenovirus, hepatitis A virus, *Cryptosporidium*, *Giardia* and *Campylobacter*). The key point is that existing, standard approaches, already used for working safely with wastewater, still apply, and no special or specific changes need to be made due to the SARS-CoV-2. The SARS-CoV-2 is just one of many pathogens including viruses potentially present in wastewater. Exposure to all pathogens in the workplace and in wastewater should be managed by 'business as usual' hygiene practices (see below).

'Business as usual' hygiene practices

- Wash your hands often with soap and water before and after eating as well as after attending the toilet. If soap and water are not available use an alcohol-based hand rub;
- Wear appropriate PPE when working in areas where exposure to untreated wastewater is possible – safety goggles, face shields (or masks), as well as increased hand hygiene;
- Avoid touching eyes, nose and mouth with unwashed hands;
- Avoid contact with others if they have cold and flu like symptoms;
- Clean and disinfect surfaces;
- Cough and sneeze into your elbow;
- Stay home if you are unwell.

Water utilities and their contractors should continue to provide safe working environments by following conventional precautions for working with wastewater. This involves providing the appropriate tools, equipment, work methods and procedures, personal protective equipment and sanitation for all workers. In addition, providing advice, such as this fact sheet, is important, to avoid unnecessary concern.

Disinfection of water and wastewater

The design and operation of processes used for the disinfection of water and wastewater is based on the most resistant pathogens present. Fortunately, coronaviruses are not among those most resistant to disinfection processes. That means that conventional disinfection methods, applied to inactivate the more resistant viruses, would be expected to readily inactivate SARS-COV-2.

For oxidant (chlorine, monochloramine and chlorine dioxide) disinfectants, the more resistant non-enveloped, protein capsid coated viruses, such as hepatitis A virus and coxsackieviruses, have historically been used to set the design and operational requirements for disinfection. The lipid-enveloped CoV viruses are typically more sensitive to these disinfectants. For instance, the virus most closely related to SARS-CoV-2, being SARS-CoV, was found to be very sensitive to chlorine and chlorine dioxide disinfection (as sensitive as *E. coli* and coliphage).[9]

For UV irradiation, double-stranded DNA viruses, such as adenoviruses, have historically been used to set the design and operational requirements for disinfection. The CoV viruses have large single-stranded RNA genomes and are considerably more sensitive to UV disinfection.

Given the above, it is considered that conventional disinfection of water and wastewater, designed and operated to meet current standards, guidelines and validation approaches, will be more than adequate to control transmission of SARS-CoV-2 via drinking water, recycled water and wastewater. No additional or modified treatment is required beyond the 'business as usual' treatment currently applied to manage such transmission risks.

Standard water and wastewater treatment and disinfection processes used to control pathogen transmission via water routes are expected to be effective on SARS-CoV-2. No changes are required.

The Australian Department of Health has published guidance for employers in response to COVID-19. The guidance refers to drinking water stating that "Drinking water in Australia is high quality and is well treated. It is not anticipated that drinking water will be affected by novel coronavirus"[5].

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Drinking water in Australia is high quality and is well treated. It is not anticipated that currently safe drinking water will be affected and made unsafe by SARS-CoV-2 if COVID-19 becomes established in Australia[5].

Risks to continuity of supply and public concern

There are real risks that a COVID-19 outbreak could cause major impacts on water and wastewater services through disruption. For instance,

- Disruptions may arise in the supply of parts, equipment and chemicals that may have direct impacts on supply.
- Staff may be unable to attend work due to becoming ill, fear of becoming ill, or due to caring duties for family members that are ill or unable to attend work or school.
- Essential services workers may be concerned about undertaking their work for fear of becoming contaminated by wastewater, however, this fear is not supported by evidence.

In addition, WSAA has prepared a Fact Sheet that highlights that drinking water supplies are safe, and that bottled water need not be consumed in place of tap water, or stockpiled, due to fears from COVID-19.[10]

Monitoring and Research

Routine water quality monitoring

Routine water quality monitoring should continue as normal, that is monitoring microbial faecal indicators of wastewater that are already widely used and well understood. This includes monitoring *E. coli* in drinking water and waters potentially affected by wastewater as well as enterococci in natural bathing waters. This type of verification monitoring of water quality is already routinely used across the country. Routine monitoring for SARS-CoV-2 is not required.

Research priorities

In specialist facilities that are equipped with adequate containment to undertake research with SARS-CoV-2, research should occur for the following purposes:

- To better understand the environmental persistence and resistance of the SARS-CoV-2 to disinfection and treatment processes.
- Where a virus is being widely shed by infected people in an outbreak situation, wastewater monitoring can provide a simple means to find out what subtypes are present.

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