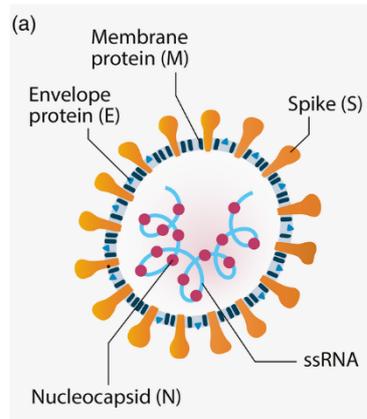


**1. What is coronavirus and its structure? How does it survive in water environment (under which conditions of pH, TDS, etc...).**

Coronaviruses are a large and diverse family of viruses. The name 'corona' comes from their round appearance and the spikes on their surface that can be likened to a solar corona (see attached image).



The data available suggests that:

- i) CoV seems to have a low stability in the environment and is very sensitive to oxidants, like chlorine;
- ii) CoV appears to be inactivated significantly faster in water than non-enveloped human enteric viruses with known waterborne transmission;
- iii) temperature is an important factor influencing viral survival (the titer of infectious virus declines more rapidly at 23°C–25 °C than at 4 °C);
- iv) there is no current evidence that human coronaviruses are present in surface or ground waters or are transmitted through contaminated drinking-water;
- v) further research is needed to adapt to enveloped viruses the methods commonly used for sampling and concentration of enteric, non-enveloped viruses from water environments.

**2. What is the fate of coronavirus in the water and wastewater treatment process?**

The virus that causes COVID-19 has not been detected in treated drinking water. Water treatment plants use filters and disinfectants to remove or kill germs, like the virus that causes COVID-19. The Environmental Protection Agency regulates water treatment plants to ensure that treated water is safe to drink. Currently, there is no evidence that the virus that causes COVID-19 can be spread to people by drinking treated water. If a coronavirus did contaminate a drinking water supply system

(perhaps one with low disinfection residual), survival might be enhanced by colonising bacteria in biofilms. If this were to occur, there could be exposure risks from the production of aerosols during activities such as showering.

COVID-19 is spread mainly through close contact from person-to-person. Previous studies have shown that coronaviruses (including SARS-CoV) can exist and maintain viability in sewage and hospital wastewater, originating from the fecal excretions of infected patients. Previous studies have also highlighted the persistence of (other surrogate) coronaviruses in aquatic environments and wastewater treatment plants. Some particular wastewater treatment processes, such as membrane bioreactors may also play an important role since they have been shown to be effective for virus removal, including for some enveloped viruses (such as coronaviruses) and some non-enveloped viruses (e.g. norovirus) that are known to be more resistant than enveloped viruses.

Current water and wastewater disinfection strategies, using chlorine and UV irradiation are anticipated to be very effective for SARS-CoV-2 inactivation, but proper operational control is always essential.

**3. Can COVID-19 virus spread through sewage system? And what measures should be in place to protect wastewater worker from being infectious by this virus?**

Recently, the virus that causes COVID-19 has been found in untreated wastewater. While data are limited, there is no information to date that anyone has become sick with COVID-19 because of exposure to wastewater. At this time, the risk of transmission of the virus that causes COVID-19 through properly designed and maintained sewerage systems is thought to be low.

Standard practices associated with wastewater treatment plant operations should be sufficient to protect wastewater workers from the virus that causes COVID-19. These standard practices can include engineering and administrative controls, hygiene precautions, specific safe work practices, and personal protective equipment (PPE) normally required when handling untreated wastewater. No additional COVID-19-specific protections are recommended for workers involved in wastewater management, including those at wastewater treatment facilities.

**4. What is your strategy to maintain a stable and continuous supply chain (chemical & PPE) for your water & wastewater treatment plant during COVID-19?**

Strategies includes constant assessment of monitoring and lab capabilities as well as the need to procure two alternative suppliers. We are balancing planning and operational needs to support continuation of supply. We are constantly monitoring and accounting for the remaining chemicals, equipment, and PPE available in the warehouse, and planning for future chemical, equipment and PPE orders depending on what is available. We are coordinating with suppliers on a regular basis. We are also developing and implementing more preventative maintenance to maintain support for our contractors.

**5. What is your experience in helping water & wastewater workers get rid of their fear of COVID-19 and encouraging them back to work and follow health & safety guideline?**

We are allowing field staff to go directly from home to the site to reduce any risk of transmission. We are constantly maintaining communications with staff, and have formed a crisis management team and developed a pandemic response plan / business continuity plan. We are conducting mock exercises based on different stages and scenarios including weather, what does the new normal look like.

**6. What is your plan to keep your business continuity and recover post COVID-19?**

Our plan involves refining the splitting of work force teams and to consider splitting maintenance teams including preventing physical interaction between teams. We have cross trained sewerage and treatment operators with network operators to ensure back filling of roles. We are utilising online tools and telecommunications for consistent interaction (long term positive legacy). We continue to engage within our industry and community (neighboring Councils and Industry bodies) for support. Our operations will benefit from additional depth in key areas (treatment operations, water quality testing) as future sickness in these teams will stretch these key skills. Our procurement / stock levels for critical items were identified and some additional stock purchased (targeting operations and repairs). In addition, we:

- Work with our Council to support the economic recovery
- Continue to keep cost focused so that as many businesses in the region are viable
- Look for opportunities to undertake necessary upgrades / renewals area whilst the impact is lower

Listen and engage to seek to work together to recover, locally and globally

**7. What have you done to minimise the risks of virus spreading where physical contact with users, customers, supplier and contractors is unavoidable.**

For customers/contractors visiting our sites we:

- Provide free masks to all visiting customers,
- Measure body temperature for all customers;
- Record customer's information details.
- Encourage customers to use online payment if possible
- Maintain social distancing while working with customers.
- Installing protection shield for reception desks

**8. What is your strategy to help people in remote areas and others, being in shortage of water supply, to deal with COVID-19? →**

Utilities have donated many items for responding and preventing activities to COVID-19 organized by provincial agencies, including:

- bottles of dry hand-sanitizer;
- automated hand-washing machines with anti-virus sanitizer;
- disinfect chambers and disinfect liquid to public health centers;
- small drinking water to quarantine camps and health testing depots

**9. What is your strategy to minimize the risk of spreading COVID-19 virus among operators and workers working in the office and on the sites?**

**Utilities are implementing the following:**

**Physical distancing:** Stay at least 1.5 or 2 m apart, no handshaking or other close physical contact

**Create separate work teams:**

Ensure that each team has the work skills that are needed to do all tasks

In this way, if one team tests positive for COVID-19, the other team has a good chance of remaining COVID-19 free

**Personal hygiene**

Ensure that there is sufficient soap or hand sanitiser at each work site

Make sure that all staff know the importance of regular handwashing, particularly after touching common surfaces, using the washroom, or working with wastewater  
Remember: no handshaking, or other close contact

**Know who has visited each site**

Record the names and contact details of all staff and visitors who visit each site, in case someone tests positive for COVID-19

**If staff unwell – do not come to work**

If staff are feeling unwell, they must not come to work – as to not risk infecting others and to stay in isolation and get tested, if possible

If a close family member is unwell; again, staff do not come to work – even if they show no symptoms, they may have COVID-19

If staff are in the office, and begin to feel unwell – tell supervisor, and then go home

**COVID-19 and wastewater/sewage**

Current PPE and hygiene measures are protective against contracting COVID-19 from sewage

**10. What is your strategy to respond to emergent incidents happening on the network and/or at the treatment plant where a big group of workers is required for the task?**

Secure support staff and your supply chains of items required for ensuring workplace health and safety (tissues, soap, antiviral wipes and/or sanitisers).

Staff from other utilities and third parties may need training to familiarize themselves with sites in case they are to be drawn upon at short notice.

Develop guidelines for each essential work requiring involvement of a group of workers (e.g. using valve key with extension to maintain social distancing, etc...)

## Questions from COVID-19 webinar

Q1: Please give us some advice on some measures to minimize the exposure to wastewater containing coronavirus?

- Develop safe work methods for working with faeces, sewage and sludge
- The use of controls to minimise the generation of aerosols and splashes (e.g. insertion seals and covers over manholes).
- Wear appropriate PPE to prevent ingestion and inhalation of aerosols and/or splashes/droplets (e.g. face shields or goggles and P2/N95 masks) when working in areas where exposure to untreated sewage droplets and aerosols is unavoidable.
- Wash hands after removal of contaminated PPE.
- Disinfect equipment and surfaces if they become contaminated with sewage.
- Change and launder clothing if potentially contaminated with sewage and shower using provided facilities.

Q2: What are measures to disinfect COVID-19 in wastewater sources suspected with coronavirus contamination?

- Chlorination pretreatment: Bleaching powder is commonly used for the chlorination pretreatment. The added bleaching powder should be flushed into the septic tank with flowing water and the residual chlorine would be measured at the outlet of septic tank in case of violation of the water quality standard.
- Chlorine-containing disinfectants (liquid chlorine, chlorine dioxide, and sodium hypochlorite): Chlorine is a kind of strong oxidizer, which is one of the most early used disinfection methods in disinfecting hospital wastewater. Usually, 30 mg/L-50 mg/L and 15 mg/L-25 mg/L chlorine is added to wastewater after primary treatment and secondary treatment, respectively.

Q3: Ariel (Water.org) kindly explain a bit on, 1. COVID-19 could be removed by conventional disinfectants. 2. It resist disinfections. Thank you.

A3: **(Dan Deere)** Yes, COVID-19 is susceptible to conventional viricidal disinfectants, such as chlorine.

Q4: Could you explain more about the problems experienced related to Public Perception and Other Impacts?

A4: **(Dan Deere)** The problems experienced related to Public Perception and Other Impacts include: people being afraid of drinking water thinking it might be contaminated with COVID-19 virus, particularly if water is sourced from downstream of sewage discharges; fear

of using recycled sewage water for irrigation of crops; fear of working with sewage, such as sewer workers and plumbers. We have had people buying bottled water and not wanting to drink tap water. We have had problems with sewer workers and plumbers being worried about working with sewage. Concerns from people that swim in waterbodies concerned about sewage discharges to those waterbodies. Concerns about high levels of chlorine being added to the water to control COVID-19 virus.

Q5: According to speakers' presentation, the highest risk of infection is from wastewater, so can you please give some advices on how to effectively treat wastewater from quarantine centers? Thank you

Theo diễn giả trình bày, nguy cơ lây nhiễm cao nhất ở phần nước thải, vậy hướng xử lý hiệu quả nước thải của các khu cách ly tập trung phải xử lý như thế nào? Xin cảm ơn!

A5: (Dr Nguyen Viet Anh) In principle, wastewater treatment for quarantine camps are similar to the treatment of wastewater from hospitals. Unfortunately, criteria of choosing quarantine centers do not take into account the water supply source and wastewater treatment facility. Therefore, the solution is that black water from toilets is required to go to septic tanks. Sludge withdrawal from septic tanks should not be conducted during the pandemic period. Grey water if it can go through septic tank is good, if not, it must be at least disinfected before being discharged to receiving body. Water supply in quarantine camp needs to be disinfected, directly taken from the tap but not from the public tank. Please refer to my article published on VWSA magazine, vol 3/2020, and advisory and precaution circular issued by VWSA.

Về nguyên tắc, XLNT khu cách ly tập trung phải tương tự XLNT bệnh viện. Rất tiếc là tiêu chí chọn Khu cách ly TT chưa xét đầy đủ đến nguồn cấp nước và công trình XLNT. Giải pháp tình thế là Nước đen từ Khu vệ sinh phải bắt buộc qua Bể tự hoại. Không hút bùn bể tự hoại trong giai đoạn có dịch. Nước xám (rửa, nhà bếp, tắm, giặt...) đi qua được các bể xử lý thì tốt, không thì ít nhất phải khử trùng toàn bộ trước khi xả ra ngoài mạng lưới thoát nước hay ra môi trường. Nước cấp ở Khu cách ly cũng phải có khử trùng, lấy nước từ vòi, không múc từ bể công cộng (như 1 số khu cách ly ở doanh trại bộ đội...). Chi tiết hơn, xin xem bài viết của tôi trên Tạp chí CTN, số 3/2020, và Công văn khuyến cáo của Hội CTNVN.