

Covid-19: More research needed on possible groundwater contamination from burial grounds

By [Yazeed van Wyk](#)

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The recent outbreak of the novel coronavirus (2019-nCoV or Covid-19) has dramatically disrupted global economies and halted people's daily activities, probably for the first time in recent history. Currently, there is no report of any clinically approved antiviral treatment or vaccines that are effective against Covid-19.



Yazeed van Wyk, research manager, Water Research Commission

This has resulted in mass burials in developed countries like Italy, Spain and the United States, where mass graves in Hart Island, New York reported an increase of 24 burials a day since the start of the pandemic. South Africa, on the other hand, is in a unique position to learn from the lessons of more developed countries in planning and preparing for increased fatalities, which might exceed the capacity of current burial and crematoria facilities. Apart from ensuring there are enough facilities, an equally important consideration is to ensure that death and burial occur safely given the highly infectious nature of the SARS-CoV-2 virus.

Research studies at field scale needed

In a viral pandemic like the one we are currently witnessing with Covid-19, there is a genuine concern amongst the public that the dead bodies of victims can aid in spreading the virus among people who work closely in handling the body. At the same time there is a huge debate on whether burying the bodies of Covid-19 victims may facilitate the viral spread through the unsaturated zone to the groundwater table. Although these are all compelling concerns, more research studies are needed, particularly at field scale to validate these claims.

Burial in any means causes soil contamination, which in turn leads to groundwater pollution via the discharge of amino acids, inorganic nutrients, phosphate and chlorides. Most contamination or pollution in the form of heavy metals from cemeteries are from coffins and embalming processes, as well as accessories during burial such as cosmetics, medical implants, and jewellery. Microbial and chemical contamination can also occur in cemeteries as a result of unmanaged, untreated and incorrectly sited sanitation services, solid waste, and wastewater which allows for the flow of microorganisms and contaminants into cemeteries.

No additional risk

In general, bodies that are treated and buried in correctly sited and constructed cemeteries do not pose a threat to public health and are not a source of pollution. The WHO guidelines clearly stipulate that to date, there has been no evidence to suggest that individuals have become infected from exposure to the bodies of persons who have died from Covid-19. If conducted according to the usual recommended health and safety practices, choosing to bury or cremate a person who has passed away from Covid-19 should pose no additional risk to persons alive or the environment. However, in South Africa, based on the population's known religious and cultural practices around death, as well as the lack of sufficient crematoriums, Covid-19 victims are highly likely to be buried in cemeteries.

South Africa also has serious issues with access to land in metropolitan areas, but also in rural areas, as a result conservation and residential developments take precedence and not cemeteries because they are not considered

sustainable. The Water Research Commission has published generic guidelines for cemeteries, mostly addressing sanitary and geotechnical risks. These have been compiled cognisant of typical contaminants emanating from cemeteries, including a variety of metals, nutrients, organics and pathogens. However, when sited properly and according to sound scientific judgement, cemeteries should protect surface water and groundwater from contamination regardless of the cause of death. Provided that the capacity of the cemetery is not breached, the placement and design of the cemetery have a built-in resilience to supply enough time for the attenuation of contaminants on-site.

Poorly sited cemeteries

In some instances, poorly sited cemeteries may be at higher risk. In these instances, groundwater or surface water will be the most direct receptors of pollution, and the most at risk will be on-site users of water such as workers. The South African Cemeteries Association (SACA) has provided interim guidelines to assist municipalities for the preparation of mass burials and cremation of Covid-19 victims.

To date, there has been no reported cases of the coronavirus that causes Covid-19 being detected in drinking water in either private boreholes or public drinking water systems coming from cemeteries. This can be related to the travel time that SARS-Cov-2 will need in order to remain infective. Travel time can be important because viruses lose their infectivity with time in the subsurface, dependent on temperature, pH, and other factors. At this stage, it is too early to predict if and through what mechanisms the SARS-CoV-2 virus can contaminate groundwater systems. However, the following steps can be taken to prevent any potential threats to the groundwater system by the novel SARS-CoV-2 virus.

Preventing potential threats

Soil textures of about 2mm in diameter combined with an unsaturated zone of at least 0.5m between the bottom of the grave and the water table are the most suitable conditions to avoid excessive moistening of the graves and groundwater contamination from any microbial pathogens (including but not limited to SARS-CoV-2 virus). The preferred burial site should have a soil of sand-clay mix of low porosity and a small fine-grain texture, and the water table should be at least 2.5m deep in order to allow for traditional grave depth of 1.8 metres. A groundwater monitoring network needs to be established to monitor boreholes in the vicinity of cemeteries, and to assess the potential risk of microbial groundwater contamination.

So far, SARS-CoV-2 does not have a high level of persistence in the environment, due to it being an enveloped virus and can be eliminated effectively by water treatment, especially chlorination, and would pose a minimal risk to drinking water. As the outbreak continues, more water-quality and hydrogeological (laboratory and pilot scale) experiments are needed before major conclusions can be drawn on their fate and transport in cemetery environments.

ABOUT THE AUTHOR

Yazeed van Wyk is a research manager at the Water Research Commission.

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