COVID 19, Human Waste and Wastewater:
A Discussion Paper for Cooperation on Water and Wastewater Management in Israel, Jordan and Palestine

Gidon Bromberg, Yana Abu Taleb, Nada Majdalani *

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Introduction

Since the outbreak of the coronavirus, COVID 19 or SARS-CoV-2, considerable research has been made in order to better understand the virus, so as to control the spread of the pandemic and discover its prevention and treatment. One aspect of the pandemic that requires further research is how the virus behaves in an aquatic environment. There is now strong evidence that the virus survives in our bodily waste and will be present when we dispose of that bodily waste (feces and urine) into the environment. The question is if it can be detected, how long the virus survives in our wastewater systems and if contact with untreated or poorly treated wastewater could be a source of infection.
For Jordan, Palestine and Israel the question is particularly relevant as much wastewater remains untreated or poorly treated, left flowing in the environment, and where it is treated, it is then widely reused for agriculture to grow food. In Israel, wastewater is reused at the highest rate in the world, 87%, with about half of the agriculture in the country grown on treated wastewater. In Jordan, greater Amman also treats its sewage and then reuses the water for agricultural production in the Jordan Valley, but in the Jordan Valley itself there are no modern sewage treatment plants and most homes dispose of their sewage in cesspits, with homes not even connected to sewage treatment infrastructure. Similarly, in Palestine most cities have poorly functioning sewage treatment plants and in villages only cesspits exist, with no collection or treatment infrastructure. Thus, in much of Jordan and Palestine wastewater may flow untreated or poorly treated into open streams, seep into groundwater and in many locations flow in the streets and nearby houses.

Image Credit: EcoPeace. Cross border streams

Coronavirus and Sewage

The coronavirus is part of a larger family of viruses that causes respiratory difficulties and fever. Viruses of this type include the Severe Acute Respiratory Syndrome (SARS), which is transmitted to humans by cats, and the Middle East Respiratory Syndrome (MERS), which is transmitted to humans by
camels. COVID-19 is caused by the new coronavirus SARS-CoV-2 that was discovered in China at the end of 2019. It’s behavior and long-term effects are still unknown. The virus is mainly transmitted through droplets generated when an infected person coughs, sneezes, or speaks. These droplets are heavy. They quickly fall on floors or surfaces. Infection can occur if you are in close proximity to a person who has COVID 19, or by touching a contaminated surface and then touching your eyes, nose or mouth before washing your hands.

Recent studies suggest that SARS-CoV-2 may be transmitted also through human waste. A recent study in China suggests that diarrhea may be a secondary way of transmitting the virus. 14 out of 138 patients (10%) in Wuhan City Hospital were diagnosed with diarrhea symptoms and nausea a day or two before the common symptoms of fever and dyspnea were developed. In addition to that SARS-CoV-2 virus RNA was detected in sewage all over the world including Europe (Netherlands, France), USA and Australia. Most recently, it was reported that minuscule traces of the virus have been found in non-potable water in the French capital, Paris.

Modern wastewater treatment plants play a major role in protecting public health since they prevent potential infections from effluent. Wastewater carried in sewerage systems should be treated in well-designed and well-managed centralized wastewater treatment works. Each additional stage of treatment, as well as retention time and dilution, results in a further reduction of the potential risk. A waste stabilization pond (an oxidation pond or lagoon) is generally considered a practical and simple wastewater treatment technology particularly well suited to destroying pathogens, as relatively long retention times of 20 days or longer combined with sunlight, elevated pH levels, biological activity, and other factors serve to accelerate pathogen destruction. A final disinfection step, such as chloride or UV is recommended so that wastewater treatment plants are optimized to remove viruses.

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Dawei Wang et Al, 2020, JAMA, Clinical Characteristics of 138 Hospitalized Patients With 2019 Novel Coronavirus–Infected Pneumonia in Wuhan, China

According to a study that was made by the University of Arizona in 2008, Coronaviruses were not found more resistant to water treatment than other microorganisms such as E.coli, which are commonly used as an indicator of treatment quality. Studies show that the survival of coronavirus is mainly dependent on temperature. Its survival potential increases at lower temperatures (Coronavirus survives at 4 degrees Celsius 3 times more than at 23 degrees Celsius). During the SARS epidemic outbreak in 2003, many viruses were detected in wastewater. Since this Coronavirus (SARS-CoV-2) belongs to the same family of SARS, it is likely that it can survive in human waste as well. Infectious viruses are in fact often found in wastewater.

The World Health Organization (WHO) on March 19, 2020 published a guidance document on water, sanitation, hygiene, and waste management for the COVID-19 virus. The WHO reported that up until that date there was no evidence about the survival of the SARS-CoV-2 virus in drinking-water or sewage. The WHO nevertheless advised to “manage excreta (faeces and urine) safely, including ensuring that no one comes into contact with it and that it is treated and disposed of correctly.” Studies conducted more recently in the Netherlands, the US and Sweden however, confirm that SARS-CoV-2 RNA has been detected in sewage. Most recently on April 17th, Eau de Paris released research results confirming the correlation between the concentration of the virus in wastewater and the rate of infection cases contributing to the sewer system; it also suggests that wastewater surveys could help predict a second wave of outbreak.

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https://www.dutchwatersector.com/news/sewage-water-as-indicator-for-spreading-of-covid-
19 and Haaretz article (Hebrew) 16 April, 2020.
https://www.medrxiv.org/content/10.1101/2020.04.12.20062679v1
Israel:

In Israel 570 million cubic meters (MCM) of treated wastewater are produced and reused in agriculture annually. However, part of the water reaches the environment as surpluses after it hasn’t been used (60 MCM).\(^\text{11}\) In total, 1538 sq. km. are irrigated with reclaimed water in Israel\(^\text{12}\). The level of treatment in Israeli wastewater treatment plants is required to be tertiary yet 50% of effluent is still treated to only secondary level. Of greatest concern is that in some of the secondary level treatment plants no disinfectant process is included.

Areas in Israel that are irrigated with secondary level effluent are: Shfelat Yehuda, Hof Hacarmel, Jezreel Valley and the Lower Galilee, Eastern Galilee, Western Galilee and Galilee Panhandle. Effluent that is treated to a secondary level is used for industry crops such as cotton and fodder, for crops that are dried in the sun for at least 60 days such as corn and wheat, and for fruit trees. Effluent that is treated to a tertiary level can be used without limitations, including vegetables.

As detailed below considerable quantities of sewage without any level of treatment or poorly treated, flow into Israel daily from streams originating in the West Bank. These streams flowing with sewage could thus carry the COVID-19 virus SARS-CoV-2 into many rural and urban settings in Israel, from Beersheva in the south, Emek Hefer Regional Council in the center of the country and Gilboa Regional Council in the north. In total there are 16 cross-border streams flowing from the West Bank into Israel all potentially carrying untreated or poorly treated sewage. From the Gaza Strip, as detailed below, coastal seawater currents can carry untreated or poorly treated sewage released from Gaza into the sea, and up the Mediterranean coast to Israel beaches.

Palestine:

Of the approximately 91 MCM of sewage produced in the West Bank\(^\text{13}\), 30% is collected in sewage network systems, only 10% is treated, and some 25 MCM of wastewater is released untreated directly into the environment as

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Israel Water Authority, 2016\(^\text{11}\)
Israel Water Authority, 2016\(^\text{12}\)
PNA, Palestinian National Voluntary Review on the Implementation of the 2030 Agenda, June \(^\text{13}\) 2018
surface runoff or from cesspits. There are only four modern wastewater treatment plants in the West Bank, located in Al Bireh, west of Nablus, Tubas and Jericho. These plants achieve tertiary level treatment and include a disinfectant process. All other wastewater that is partially treated reaches a secondary or lower level of treatment with no disinfectant process. An additional 5.5 MCM of untreated sewage are released from Israeli settlements in the West Bank. Most recently, the Beitar Elite settlement, where the infection rate is very high, poses possible concern to Palestinian residents of Nahalin and Wadi Fukin due to the regular untreated sewage spills into these communities agricultural fields.

Photo Credit: EcoPeace. Sewage flow down Hebron Stream.

The situation in the Gaza Strip has in recent years improved but reasons for great concern persist. A World Bank report reflecting data from 2017 showed that only 1 MCM of all wastewater in Gaza is treated and reused for irrigation. Due to the recent completion of several modern treatment plants an estimated 41.01 MCM of the total 80 MCM volume of generated wastewater in Gaza are now treated to tertiary or secondary level and environmentally


Al Bireh wastewater treatment plant includes a UV unit for disinfection; it has been shut down to reduce cost, given that a highly treated effluent is not utilized for reused. The UV unit can be put back into function at any time from a technical standpoint. Source: EcoPeace ME site visit and interview with the Operator, February 2020.

PNA, Palestinian National Voluntary Review on the Implementation of the 2030 Agenda, June 2018
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discharged\textsuperscript{19}. 22 MCM of sewage raw or with poor treatment flows directly into the Mediterranean sea from streams, making up 35% of collected sewage. An additional 20 MCM of sewage seeps through cesspits into the groundwater. The large quantity of sewage that flows into the Mediterranean Sea contaminates Gaza’s beaches and fishing zone and is then carried up the coast by sea currents to Israeli beaches. Though survival time for viruses in the sea and sun are short lived, they can be found in the sand layer and survive for several days, carried by waves from beach to beach, endangering public health\textsuperscript{20}.

![Satellite image showing organic matter from Gaza sewage moving with sea currents along the coast of Gaza and moving up the coast of Israel. Source: Israel Oceanographic and Limnological Research Institute](image)

In addition to wastewater concerns, both the West Bank and Gaza suffer from severely limited access to domestic water supply. Water throughout Palestine is intermittently supplied with all homes having to store domestic water on rooftops, refilled each time water is supplied. In the West Bank the shortage of domestic water is most evident during the long summer months, when some cities in the southern West Bank can receive municipal water once every several months. In the Gaza Strip 97% of groundwater is no longer potable

\textsuperscript{19} PWA, Preparation of the PWA Development Plan 2020 – 2022, unpublished report, 2019
\textsuperscript{20} Jacob Silverman et al, Israel Oceanographic & Limnological Research, LTD, Untreated sewage discharge from the Gaza Strip as a Possible cause of water quality deterioration at southern Israel and Ashqelon VID desalination plant inlet, July 2017
with a population of 2 million people that are dependent on small desalination plants or water purchased from Israel.

The status-quo in water and sanitation conditions is largely bound by Article 40 of the Oslo Interim Agreement which stipulated limited access to groundwater for Palestinians, and is cause for subsequent failures in reaching agreed upon long-term substantial solutions. The combination of poor level of sewage treatment, lack of disinfectant in wastewater that is treated and lack of fresh water supply in regular circumstances are a cause for concern, that in the current state of pandemic outbreak requires urgent measures from all sides if a national and regional health crisis is to be avoided. Gaza in particular has the potential to ignite a public health crisis.

**The Kingdom of Jordan**

In Jordan 65% of households are connected to sewage networks, mostly in the greater Amman and Irbid areas, producing 165 MCM of sewage that is treated in modern wastewater treatment plants to tertiary level and mixed with fresh water for reuse in agriculture.\textsuperscript{21} However, annually 101 MCM of sewage remains untreated and seeps into groundwater sources through cesspits that flows into wadis and streams. Such is the case in the Jordan Valley where for more than 600,000 residents, only 6% of households are connected to a sewage system, with the rest using cesspits and no treatment to dispose of their sewage, often resulting in sewage flows seen in residential streets. High pollution levels have been found in the springs in the Jordan River, from the east and west banks of the river, where over a million pilgrims from around the world come to be baptized annually.

Photo Credit: EcoPeace. Cesspit overflow in streets of Jordan Valley communities.

:\textsuperscript{21} Jordan Water Sector Facts and Figures, Ministry of Water and Irrigation, 2017
Jordan too increasingly faces a domestic water crisis. Throughout the year water is supplied on an intermittent basis, compounded today by both the Syrian refugee crisis and climate change. Prior to the Syrian refugee crisis in Jordan, households in Amman were supplied with water two days every week. Allocation today is cut to only 8 hours a week and outside the capital water can be supplied once every two weeks depending on the area and is stored in tanks usually found on property rooftops to be used until municipal water is supplied again.

Implication of water and wastewater management in rural areas such as the Jordan Valley is crucial to the environment and for social wellbeing especially that the Jordan Valley is the agricultural heart of Jordan producing 70% of its total fruits and vegetables.

**Need for Regional Cooperation**

The need to advance regional cooperation in the water and sanitation sector has been present for decades. Now with the COVID-19 pandemic, compounded further by climate change, there exists a level of urgency to cooperate, that if left to business as usual could further increase the public health crisis and contribute to further periods of complete lock down, threatening national and regional security for Israel, Palestine and Jordan.

In general terms this requires political will from all sides to deepen cooperation and refrain from unilateral actions and making statements that are seen by the other as inciting. In the water sector, the Joint Water Committees (JWC), Israeli / Palestinian and Israeli / Jordanian, hold the mandate to advance solutions. For practicality reasons the sides have often worked through additional mechanisms. Deeper cooperation is needed government wide, so that the development needs and associated financial requirements of each side, for the water and sanitation sector, infrastructure, health sector and beyond are met. The Middle East Consortium of Pandemic Diseases a regional consortium of Israeli, Palestinian, and Jordanian health professionals is an example of best practice to prepare for pandemic outbreaks. The organization now needs to be revamped having been greatly hampered in its work due to the anti-normalization movement\(^{22}\).
Recommendations

Recommendations to Israeli authorities:

1. Advance research to examine the presence and especially the survival of SARS-CoV-2 virus in wastewater treatment plants as well as its resistance to disinfection processes. Detection of the virus in wastewater could lead to epidemiological conclusions and an understanding of where the affected population concentrations are.\(^{23}\)

2. Undertake a review of all wastewater treatment plants in Israel to ensure all have disinfection processes essential for the removal of the virus from all effluents.

3. Conduct regular epidemiological testing of the workers who came in contact with wastewater or effluent, including farmers who utilize treated wastewater. Priority testing should be targeted towards wastewater treatment plant workers and farmers using effluent that is known not to have gone through a disinfectant process.

4. Test all cross border streams for SARS-CoV-2 virus RNA and consider application of disinfectants along the banks of streams carrying wastewater.

5. Test the beaches and in particular the beach sand of Israeli beaches from Zikim to Ashdod for viruses in general and SARS-CoV-2 in particular.

6. Undertake a review of all wastewater treatment plants in Israeli settlements to ensure all have a disinfection process essential for the removal of the virus from all effluents.

Recommendations to Palestinian authorities:

1. Upgrade all wastewater treatment plants in Palestine to ensure all have disinfection processes essential for the removal of the virus from all effluents.

2. Conduct regular epidemiological testing of the workers who came in contact with wastewater or effluent.

3. Consider advising all home-owners where no sewage collection exists to add disinfectant to home cesspits, with priority attention to be given to homes where there are known cases of COVID-19.

4. Test all wadi’s and streams in Palestine for SARS-CoV-2 RNA and consider application of disinfectants along the banks if they are carrying wastewater.

5. Test livestock that graze in wadi’s and streams in Palestine where wastewater is present.

6. Test the beaches of Gaza for viruses in general and SARS-CoV-2 in particular.

Recommendations to Jordanian authorities:

1. Undertake a review of all wastewater treatment plants in Jordan to ensure all have disinfectant processes essential for the removal of the virus from all effluents.

2. Conduct regular epidemiological testing of the workers who came in contact with wastewater or effluent, including farmers who utilize treated wastewater. Priority testing should be targeted towards wastewater treatment plant workers and farmers using effluent that is known not to have gone through a disinfectant process.

3. Consider advising all home-owners where no sewage collection exists to add disinfectant to home cesspits, with priority attention to be given to homes where there are known cases of COVID-19.

4. Test all wadis and streams in Jordan for SARS-CoV-2 RNA and consider application of disinfectants along the banks if they are carrying wastewater.

5. Test livestock that graze in wadis and streams in Jordan where wastewater is present.

6. Advance the building of sewage collection and treatment infrastructure in the Jordan Valley.

Recommendations for Regional Cooperation

1. Share all relevant information from the epidemiological investigations undertaken.

2. The Israeli / Palestinian JWC should prioritize and remove all political hurdles towards the building of new wastewater treatment plants in the West Bank and Gaza with disinfectant processes.

3. The Israeli / Palestinian JWC should prioritize and remove all political hurdles towards the increase supply of domestic water to all Palestinians to better meet hygiene needs at this time.
4. For the Gaza Strip, Israeli / Palestinian and international cooperation is needed to increase electricity supply in general and so that wastewater treatment plants in Gaza are able to operate continuously.

5. The Israeli Jordanian JWC should prioritize the sale of additional water, if needed from Israel to Jordan, to meet minimum domestic Jordanian needs.

6. Israeli and Jordanian authorities should increase testing of the Jordan River for pollutants in general and SARS-CoV-2 virus in particular.

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