



Assessing the presence of SARS-CoV-2 in wastewater and health implications for WWTP workers and water reuse



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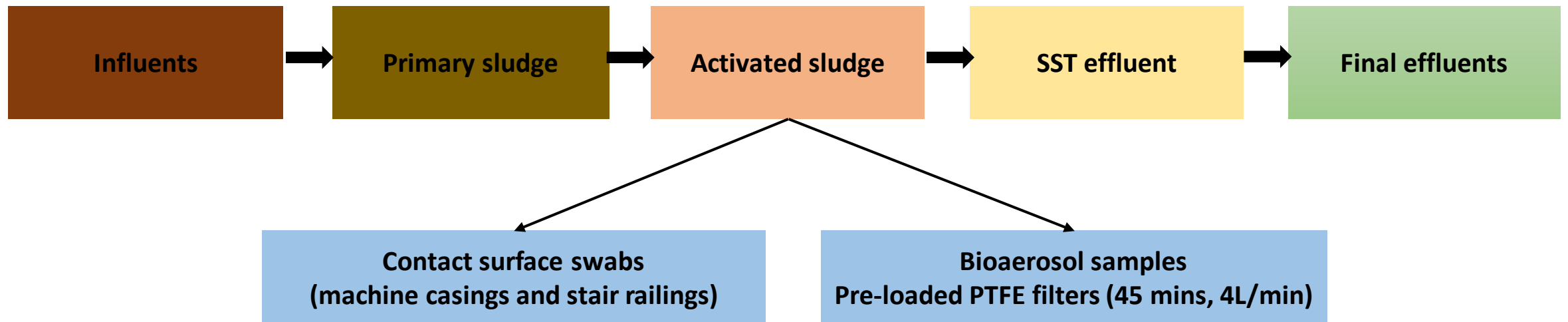
Background

- Detection of SARS-CoV-2 RNA in wastewater in the context of WBE.
- Potential health risks to workers at WWTPs and reuse of treated wastewater effluents?
- Viable/infectious SARS-CoV-2 has not been isolated from wastewater.
- No reported cases of COVID-19 transmission through wastewater.
- According to the WHO, current treatment technologies are able to inactivate the virus.
- A few studies demonstrate the persistence of viable SARS-CoV-2 in spiked wastewater.
- Assessing potential occupational risks is relevant.
- Empirical evidence is needed to better understand the behaviour of SARS-CoV-2 in wastewater environments.

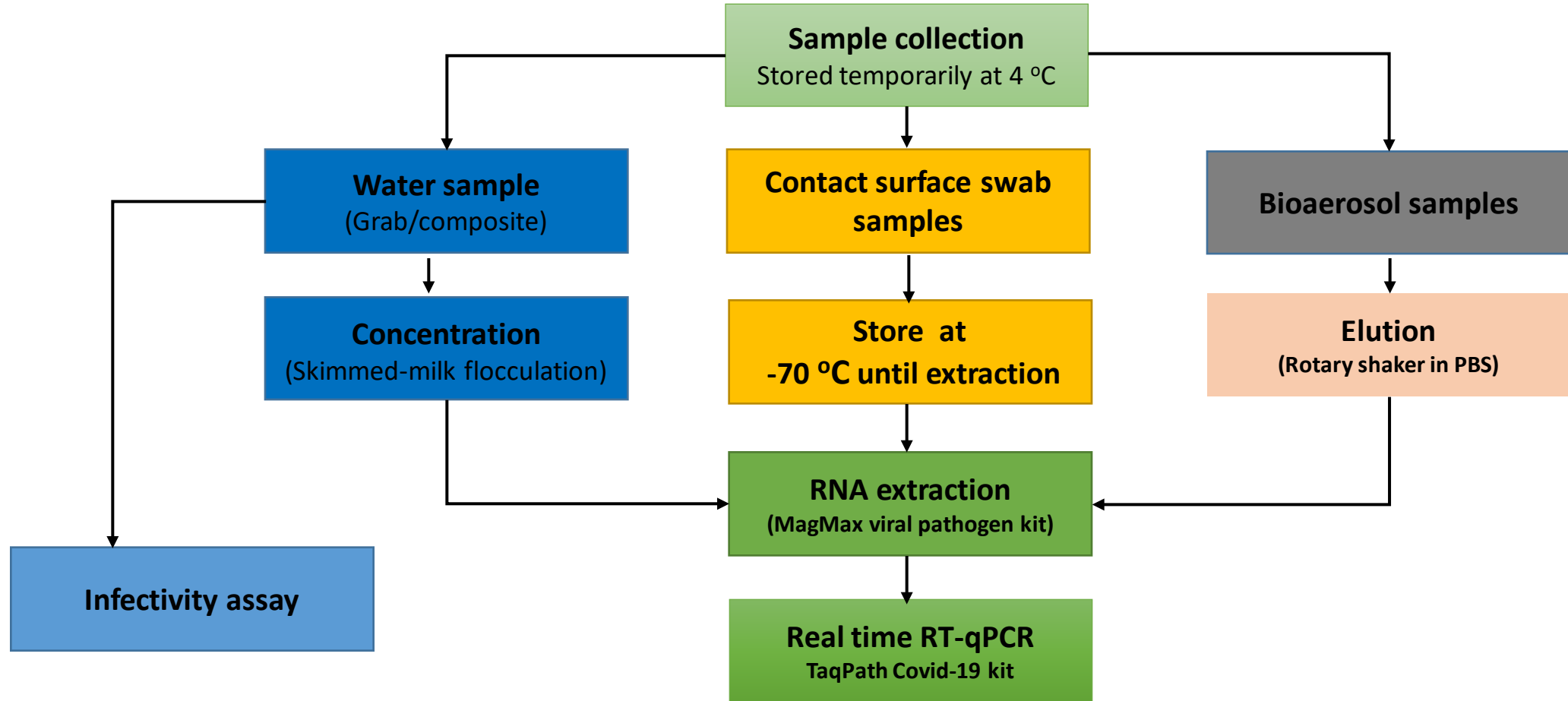
What we set out to do

- Assess the presence and removal of SARS-CoV-2 RNA in wastewater at three WWTPs in Gauteng (A, B, C).
- Assess viability/infectivity of SARS-CoV-2 in wastewater.
- Determine genetic diversity of detected SARS-CoV-2 genetic fragments.

Sampling points along treatment train



Sample handling



Results

1. SARS-CoV-2 detection (presence/absence) summary

		Sampling week and site																																													Total positive			
		1			2			3			4			5			6			7			8			9			10			11		12		13		14		15										
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	B	C	B	C	B	C	B	C	B	C									
Sample Type	Influent	Red	Red	White	Red	Red	Red	White	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	26/35 (74%)	
	Primary sludge	Red	White	White	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	26/26 (100%)
	Activated sludge	White	Green	White	White	Green	Red	White	Red	Red	White	Red	Red	White	Red	Red	White	Red	Red	White	Red	Red	White	Red	Red	White	Red	Red	White	Red	Red	White	Red	Red	White	Red	Red	White	Red	Red	White	Red	Red	White	Red	Red	White	Red	Red	19/29 (66%)
	Secondary settling tank effluent	Red	Red	White	Red	Green	Green	Red	White	Green	Red	Red	Green	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Green	Red	Red	Green	Red	Red	Green	Red	Red	Green	Red	Red	Green	Red	Red	Green	Red	Red	Green	Red	Red	Green	20/28 (71%)
	Final treated effluent	Red	Red	White	Red	Green	Red	White	Red	Red	White	Green	Green	Red	Red	Red	White	Green	Red	Red	Red	Red	Red	Red	Red	Red	Red	Green	Red	Red	Green	Red	Red	Green	Red	Red	Green	Red	Red	Green	Red	Red	Green	Red	Red	Green	Red	Red	Green	16/28 (57%)
	Contact surface swab	White	Red	White	White	Green	Red	White	Red	Green	White	White	White	White	White	White	White	Red	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	4/16 (25%)
	Bioaerosol	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White	0/10 (0%)
Total positive																																															111/172 (65%)			

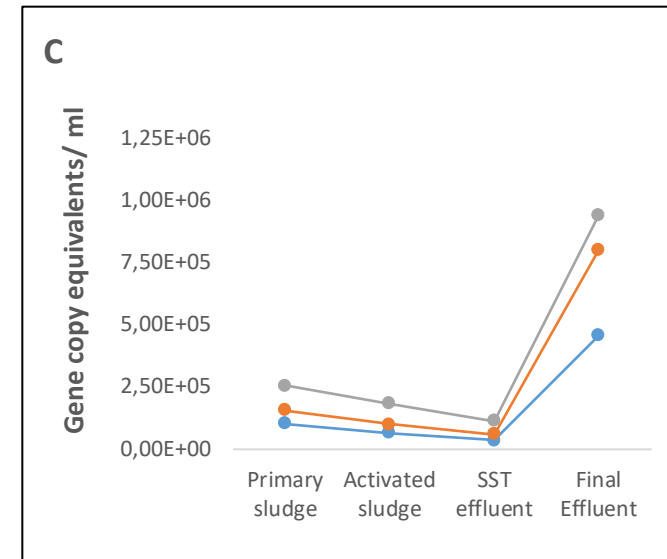
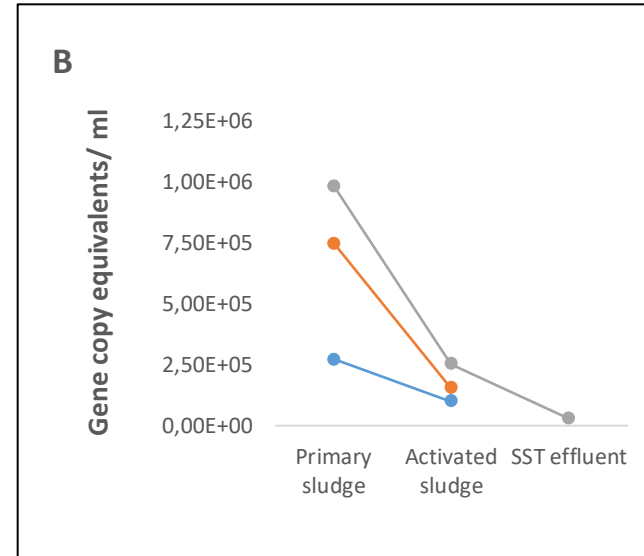
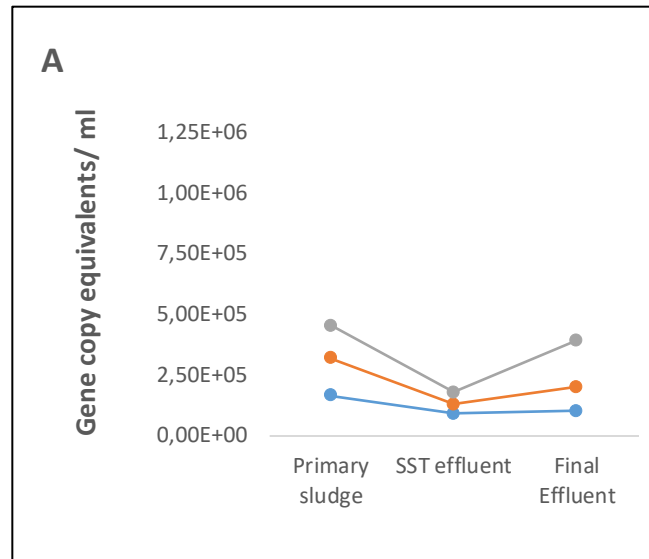
Key



: Positive detection result for SARS-CoV-2 RNA
 : Negative detection result for SARS-CoV-2 RNA
 : Sample not collected

A : WWTP A
 B : WWTP B
 C : WWTP C

2. Fate of SARS-CoV-2 genetic fragments in wastewater



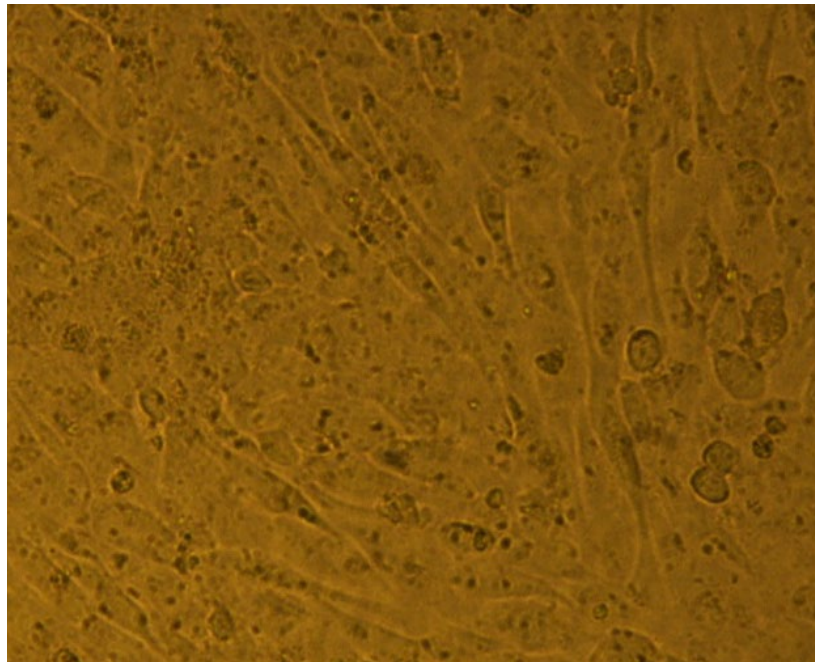
—●— N gene —●— ORF1ab —●— S gene

Gene copy equivalents/ml for SARS-CoV-2 positive samples from WWTP A, B and C for week 5.

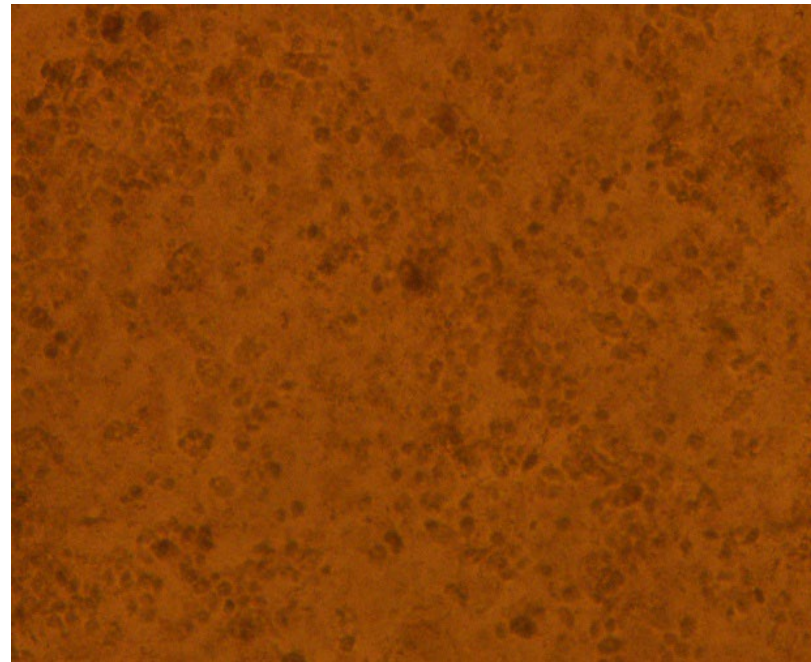
Work in progress

- ◆ Infectivity assay trials
 - ◆ Lab spiked samples
 - ◆ Field samples
- ◆ Whole genome sequencing for diversity determination

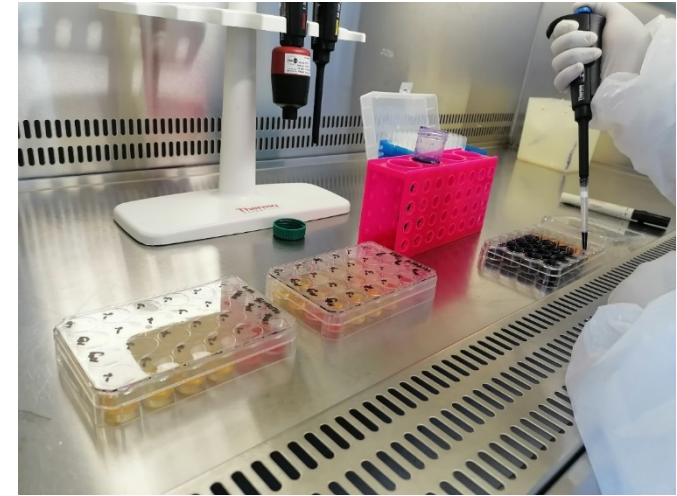
Vero E-6 cells 5 Days post infection



Control



Spiked with wastewater





Conclusion

- A majority of the samples reflected positive results for SARS-CoV-2 RNA.
- Treatment processes were capable of supporting the decay SARS-CoV-2 RNA complete removal was not achieved.
- Presence of SARS-CoV-2 genetic fragments in swab and activated sludge samples important to note.
- Potential risks to wastewater workers remain to be determined.
- Positive detection of viral RNA alone does not point to a health risk in wastewater workers or reuse of treated effluents.

Thank you



- Tshwane Wastewater Treatment Operations
 - WRC Reference Group members
 - Dr Tanusha Singh
 - Don Jambo