MEDIA FACTSHEET

WASTEWATER-BASED SURVEILLANCE FOR COVID-19 AND ZIKA

Wastewater Testing for COVID-19

1 Wastewater testing has supported Singapore's COVID-19 response and continues to be an important surveillance indicator as we live with COVID-19.

2 Singapore was an early adopter globally of wastewater testing to track COVID-19 prevalence. Soon after COVID-19 emerged, the National Environment Agency (NEA) began exploring wastewater testing from February 2020, and progressively expanded the wastewater sampling network. Working closely with the Ministry of Health (MOH), wastewater testing was initially deployed to facilitate COVID-19 case detection and contact tracing, and has since transitioned to focus on situational monitoring. Besides providing an indication of whether COVID-19 infections are rising or decreasing in the population wastewater surveillance also reveals the COVID-19 variants in circulation in Singapore.

3 To achieve comprehensive coverage, NEA has progressively expanded the wastewater sampling network to cover more than 500 sites across Singapore *(refer to Annex A for more information on how we have implemented automated solutions in wastewater sampling and laboratory testing).* Analysis of data from 1 July 2021 to 9 October 2022 showed that the concentration of COVID-19 viral fragments in wastewater from the community showed very strong correlation (r = 0.9[1]) with reported COVID-19 cases.

4 The Wastewater Viral Load Index in the community (Figure 1) provides an additional indicator to track the COVID-19 situation. The Index is a three-day moving average of COVID-19 virus levels in wastewater samples collected from all testing sites in the community. The Index is also overlaid with the daily number of reported and estimated COVID-19 cases.

[1] r refers to the correlation coefficient. An r value of 0 indicates no correlation, and a value of 1 indicates perfect positive correlation. A value of 0.91 indicates very strong correlation.

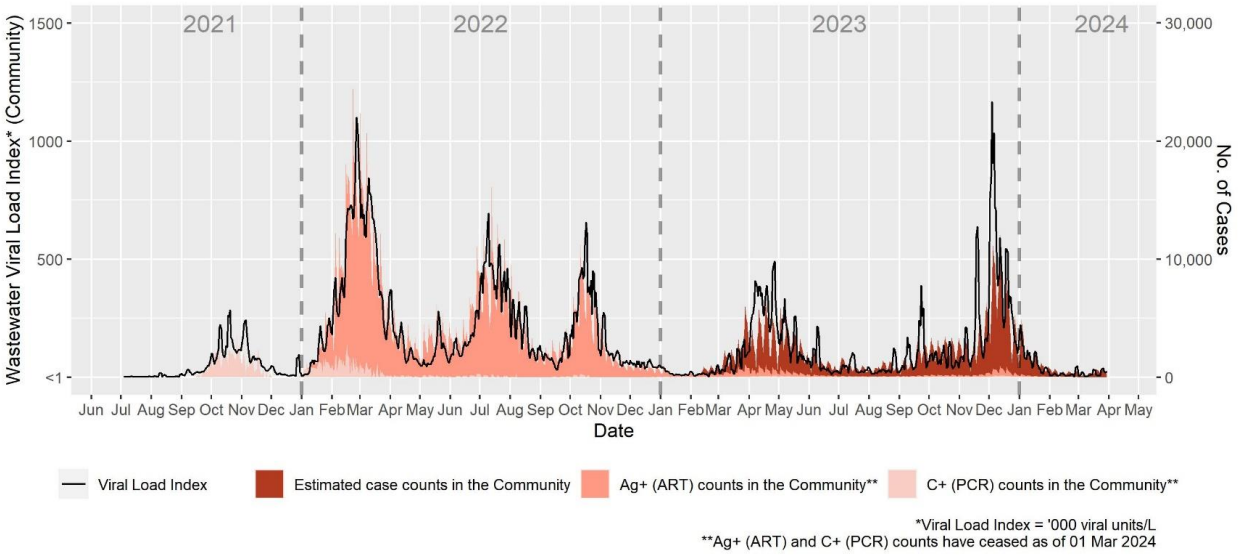

Figure 1: COVID-19 Cases and Virus Levels in Wastewater over time (1 Jul 2021 – 1 Apr 2024). The line graph (in black) reflects the daily 3-day moving average (3DMA) of wastewater COVID-19 virus levels from all testing sites in the community. The stacked area chart (in pink) reflects the daily number of COVID-19 cases reported in the community and stacked area chart (in red) reflects the daily number of COVID-19 cases estimated in the community.

5 While there has been good correlation between COVID-19 virus levels in wastewater and COVID-19 case counts, some short-term fluctuations occasionally occur. This could be due to changes in case ascertainment, including changes in community testing practices or changes in virus shedding load in wastewater. Virus shedding load may vary for different reasons, such as different COVID-19 variants' shedding loads and duration, and the evolving immune status of our population due to past COVID-19 infection or vaccination.

Wastewater Surveillance for Zika

6 Since mid-2023, wastewater surveillance has been applied to monitor Zika transmission in Singapore. Data not only guides vector control by NEA, but could also allow authorities to alert residents of potential Zika transmission. In February 2024, MOH and NEA alerted that there was potential Zika transmission at Boon Lay Place when enhanced surveillance involving wastewater and mosquito testing revealed persistent Zika virus signals in the area after a single Zika case was reported in December 2023.

Interagency Collaboration

7 Singapore's wastewater sampling programme conducted by NEA is supported by the National Water Agency PUB, HTX (Home Team Science and Technology Agency), Singapore Centre for Environmental Life Sciences Engineering (SCELSE), Nanyang Technological University, and National University of Singapore. Collaborations with industry and academic partners include Agency for Science, Technology and Research (A*STAR) and the Public Sector Science and Technology Policy and Plans Office (S&TPPO). These strong partnerships have enabled innovative solutions in wastewater surveillance to be developed within a short period of time, to respond to the national need.

8 NEA and the network of partners will continue to conduct research and development to build on the wastewater testing system, to support public health in Singapore.

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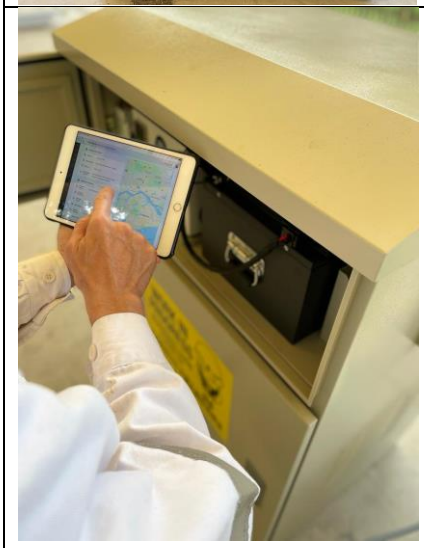
ANNEX A

Adopting Automated Solutions in Wastewater Sampling and Laboratory Testing

To support the scale of the wastewater surveillance programme, NEA has implemented automated solutions across various wastewater processes, such as the Autosampler Live Monitoring System (ALMS) and NEA-Wastewater Aliquoting Valence Engine (WAVE).

Autosampler Live Monitoring System (ALMS)

ALMS is a cloud system that enables remote-monitoring and control of the autosamplers deployed islandwide. This allows NEA to remotely track the performance of the autosamplers.

	• A Remote Terminal Unit (RTU) is installed in the housing unit and connects the autosampler system to the cloud server, allowing live tracking and remote control of the autosampler.
	• ALMS provides remote access to all autosampler units deployed across Singapore. • Using handheld devices (e.g. phone, tablet), information on any of the autosamplers can be accessed, including battery life, door sensor, and whether the collections are successful or unsuccessful. • With this system, the sampling schedule can be programmed off-site. This has helped to streamline resources, as it reduces the need to make physical trips to the autosamplers and reduces autosampler downtime.

NEA-Wastewater Aliquoting Valence Engine (NEA-WAVE)

NEA-WAVE was co-developed with A*STAR and the Public Sector Science and Technology Policy and Plans Office (S&TPPO), with technical support from an industry partner, KA Industrial Engineering Pte Ltd, to process wastewater in an efficient, safe and precise way. It reduces manual processes, as it is equipped with robotic arms that can automate liquid handling steps in the virus concentration process.

With NEA-WAVE, time savings of up to 2 hours per day and manpower savings of 30 per cent are achieved. The system enables sustainability and scalability of operations, where manpower savings can then be diverted to other functions such as quality management and research.

	• NEA-WAVE machine comprises four different BSC units performing separate steps for wastewater virus concentration. • Each unit performs a different step in wastewater virus concentration, while incorporating workflows for biosafety and sample chain-of-custody.