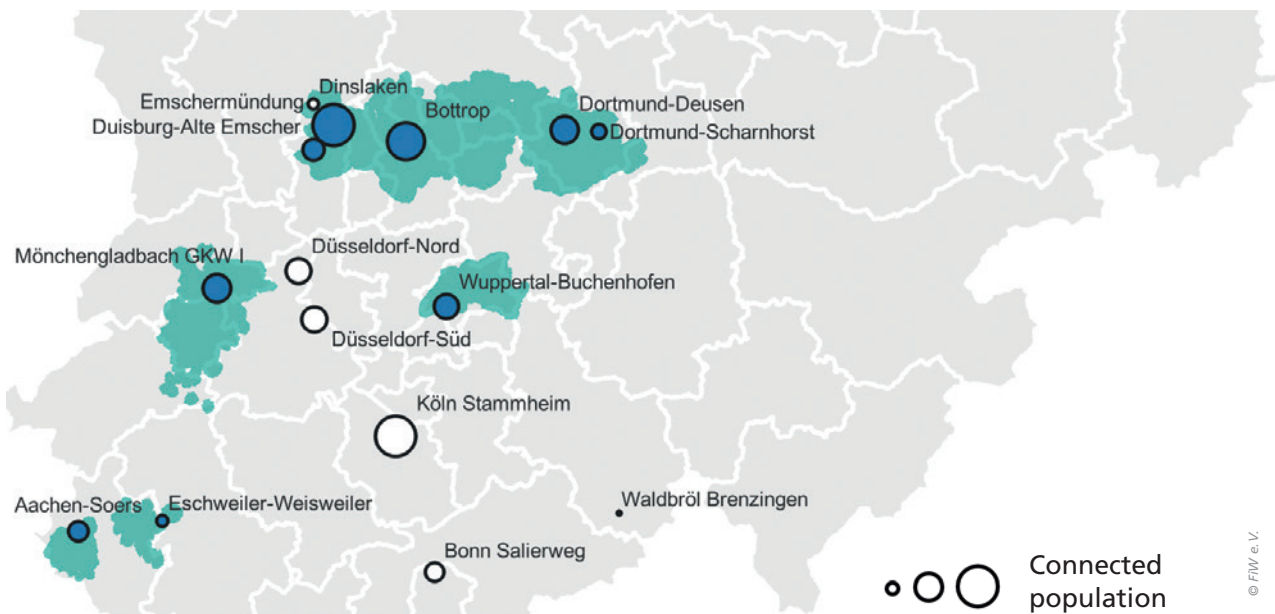


# CORONA-WASTEWATER SURVEILLANCE – TRANSFER FROM RESEARCH INTO ROUTINE APPLICATION

Holistic evaluation of available findings of SARS-CoV-2 wastewater monitoring for the pandemic assessment in North Rhine-Westphalia



In the BMBF-funded project COVIDready, FiW is working in cooperation with Emschergenossenschaft and Lippeverband (EGLV), the Institute of Environmental Research at the RWTH Aachen (ISA) and the University Hospital of the Goethe University Frankfurt (KGU) to develop the technical basis, workflows and interfaces with the health authorities for the practical application of wastewater-based epidemiology. The project made groundbreaking progress in establishing a decentralized workflow, in the early detection of variants of concern and in the development of consistent data evaluation routines. EGLV, FiW, and KGU are also supporting the State Center for Health and the Ministry of Labor, Health and Social Affairs of the state of North Rhine-Westphalia in the overall evaluation of the available findings of the Corona wastewater monitoring in NRW. The results are provided for the nationwide pandemic radar of the Robert Koch Institute (RKI).

Since infected individuals also excrete SARS-CoV-2 genetic material in their feces, wastewater monitoring provides an integral overview of the pandemic situation in the catchment area of sewage and wastewater treatment plants - irrespective of individual testing of the population. Within the framework of the BMBF-funded joint project "Decentralized

SARS-CoV-2 Monitoring in wastewater: Development of a validated analytical method for wastewater laboratories at sewage treatment plants" (COVIDready), five wastewater treatment plants of EGLV and another four plants of the water boards WVER, Niersverband and Wupperverband are being examined twice a week in order to establish an

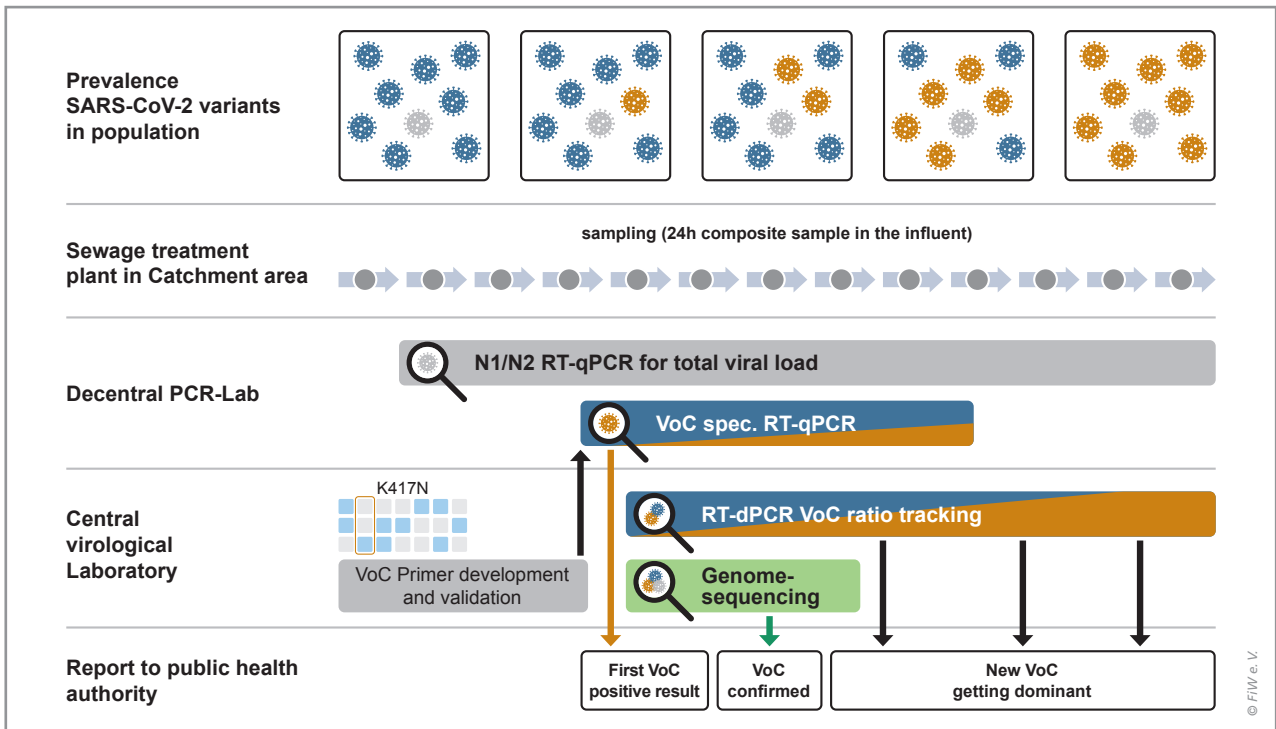


Fig. 2: Decentralised, successive workflow.

integral trend monitoring and early detection of variants of concern (VoC). The sampled nine sewage treatment plants treat the wastewater of just under 20% of the population of NRW. Together with five sites funded by NRW and three sites funded by the EU pilot project ESI-CorA, the pandemic development can be estimated for around 5.3 million inhabitants or just under 30% of the population in NRW.

### WORKFLOW FOR WASTEWATER LABORATORIES

In COVIDready, a successive workflow with several PCR-based detection methods was developed (Fig. 2). The SARS-CoV-2 viral load is determined in 24h composite samples by means of N1/N2-detecting primers in decentralized wastewater laboratories. The virus load of EGLVs sites is quantified in its own collaborative laboratory in Essen (a joint venture with the Ruhrverband). The viral loads of the other sites are analyzed in the environmental analytical laboratory of ISA. Both laboratories use the same workflow. Due to in-house logistics and analytics, the quality-controlled results can be transmitted in less than 48 hours, at EGLV even on the same working day.

### EARLY DETECTION OF CONCERN VARIANTS

Simultaneously to the quantification of N1/N2 gene copies, at times where relevant new virus variants are detected in humans, specific PCR primers and gene probes will be provided by KGU. These allow the decentralized monitoring for characteristic mutations of these VoC. Conspicuous findings can be analyzed by digital PCR and next generation sequencing (NGS) in a central laboratory. The mutated fractions are quantified by digital PCR. Publication of the findings happens in close communication with the relevant health authorities. Based on this workflow, in December 2021 the spread of the Omicron BA.1 variant and in May/June 2022, the prevalence of Omicron BA.4/BA.5 was monitored and the results published (Wilhelm et al., 2022a,b).

### DATA EVALUATION: DEVELOPMENT OF TREND INDICATORS

Based on current findings, the SARS-CoV-2 gene copy load between the sampled wastewater treatment plants is not directly comparable - even when analyzing the same target genes. Also, normalization of the load to

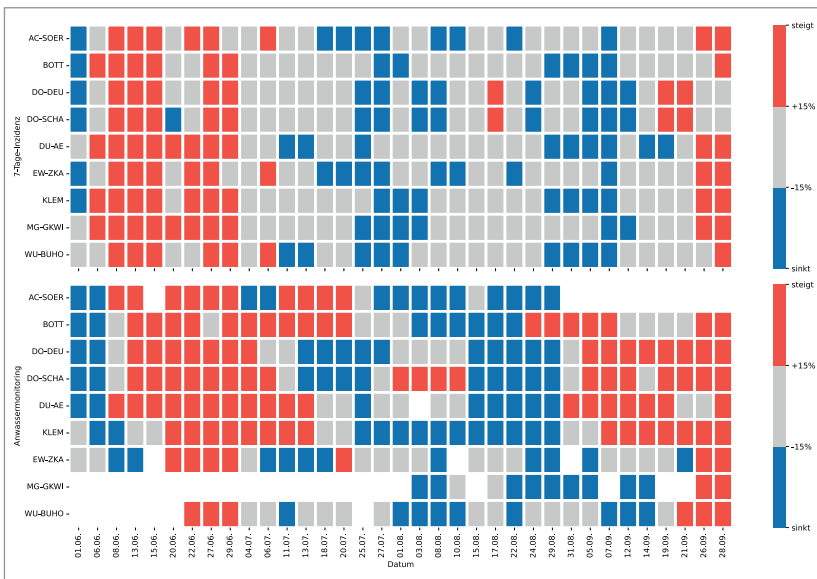


Fig. 3: Trend analysis as heat map.



<https://covidready.de/>

the nominally connected individuals, the dry weather influent, or surrogate viruses has so far not provided a uniform reference value between different sites and different analytical workflows. The detection of outliers without a uniform reference value remains a challenge. Therefore, a statistical outlier detection in combination with a wastewater-technical evaluation of influences such as precipitation events, and other parameters on the individual wastewater analyses is being developed. The classification of current trends in viral load is carried out in the categories „Increasing trend“, „Decreasing trend“ and „No reliable statement possible“.

Fig. 3 shows a trend analysis of SARS-CoV-2 viral loads measured in 9 wastewater treatment plants, based on a percentage deviation of the current two-weeks moving-average compared to a defined previous time window. The results are compared to the trend development of the estimated incidence in their respective catchment areas. In September 2022 increasing trends in the wastewater were detected even before the reported incidence of individual PCR testing captured the upcoming Covid19 fall wave (Fig. 3).

## HOLISTIC EVALUATION

In addition to COVIDready, the pilot project ESI-CorA, in other research projects and in state initiatives wastewater tests are also carried out by a wide range of commercial laboratories. The data are sent via the federal states to the German Environment Agency and from there quality-assured, normalized and sent weekly to the RKI for use in the RKI pandemic radar.

On behalf of the NRW State Center for Health (LZG.NRW) and the Ministry of Labor, Health and Social Affairs of the State of North Rhine-Westphalia (MAGS.NRW), EGLV, FiW and KGU support the state of North Rhine-Westphalia in the wastewater-technical and virological evaluation of the SARS-CoV-2 monitoring data. For this purpose, regular reports and graphical evaluations are compiled and assessed via the COVIDready-methodology. Especially the water boards can play a key role in the application of a regional wastewater monitoring and the cross-city cooperation with the health authorities. Shortly, wastewater-based epidemiology can detect other pathogens and common health threats in wastewater.

## Project overview

### PROJECT TITLE

COVIDready – Decentralized SARS-CoV-2 monitoring in wastewater: Development of a validated analytical method for wastewater technical laboratories at wastewater treatment plants

### PROJECT PERIOD

2021 – 2023

### PROJECT PARTNERS

Lippeverband (LV), Institut für Siedlungswasserwirtschaft der RWTH Aachen (ISA); Johann Wolfgang Goethe-Universität Frankfurt, Institut für Medizinische Virologie des Universitätsklinikums Frankfurt (KGU)

### ASSOCIATED PARTNERS

QIAGEN GmbH; Endress+Hauser Conducta GmbH+Co. KG (in cooperation with the subsidiary Analytik Jena)

## ASSOCIATED LOCATIONS

WVER, Niersverband und Wupperverband

## FUNDING

SPONSORED BY THE



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of Education  
and Research

## PRINCIPAL

Landeszentrum Gesundheit  
Nordrhein-Westfalen



Landeszentrum Gesundheit NRW, FiW subcontracted by the Emschergenossenschaft

## SUPERVISED BY

Projekträger Karlsruhe (PTKA)

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## STATUS

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