

WASTEWATER-BASED EPIDEMIOLOGICAL SURVEILLANCE OF THE SARS-COV-2

WEEKLY REPORT

RESULTS OF 15/01/2024

Authors: R. Janssens¹, H. Maloux¹, S. Hanoteaux¹, V. Hutse¹, L. Van Poelvoorde², N. Roosens², B. Verhaegen³, K. Van Hoorde³, K. Dierick³, K. Blot¹, M. Lesenfans^{1*}

¹ Sciensano, Service Epidemiology of infectious diseases

² Sciensano, Transversal activities in Applied Genomics

³ Sciensano, Service Foodborne pathogens

*Contact and Info: wastewater.info@sciensano.be

In collaboration with:



With the funding of:



1. Table of contents

1. Table of contents	2
2. Summary	3
3. Introduction	4
4. Methodology	4
4.1. SAMPLE COLLECTION AND ANALYSIS	4
4.2. WASTEWATER RESULTS	5
4.3. ALERTING INDICATORS	5
4.4. CAUTION POINTS FOR THE RESULTS INTERPRETATION.....	6
5. Results	7
5.1. NATIONAL LEVEL	7
5.2. REGIONAL LEVEL.....	10
5.3. PROVINCIAL LEVEL	12
5.4. INDIVIDUAL CATCHMENT AREAS LEVEL.....	13
6. Appendix – Areas classified by indicator	15

2. Summary

In the present work, the circulation of the SARS-CoV-2 virus in the environment is assessed based on three alerting indicators. The analysis of wastewater samples collected in 30 wastewater treatment plants covers 38% of the Belgian population. The results of the wastewater surveillance are a complementary source of information to the infection cases number. Indeed, the wastewater results do notably include all asymptomatic persons, and are independent of the testing strategy.

Here are the conclusions based on the latest results of January 15th 2024 (Week 3)¹:

- At the national level: The number of areas in High Circulation is stable, with 13 areas in alert. The Increasing Trend indicator is stable, with none area in alert. Overall, the viral loads are at a high level compared to the 9th wave and stable.
 - At the regional level: The High Circulation is in alert in Flanders. None of the three indicators is in alert in Brussels and Wallonia.
 - At the provincial level: The Increasing Trend indicator is not in alert in any province, and was in none last week. The Fast Increase indicator is only in alert in the province of Antwerpen, and was in 2 provinces last week. The High Circulation indicator is in alert in 5 provinces: Antwerpen, Limburg, Luxembourg, Namur and Oost-Vlaanderen, and was in 5 provinces last week.
 - At the covered areas level: among the 30 areas covered, the number of treatment plants in alert for the different indicators are 0 for the Increasing Trend indicator, 6 for the Fast Increase indicator, and 13 for the High Circulation indicator.
-

The wastewater situation can be followed on a weekly basis on:

- The graphics available on the public [COVID-19 dashboard](#)
 - The epidemiological update published on Fridays by the Risk Assessment Group (RAG) after validation by the Risk Management Group (RMG) in [French](#) and [Dutch](#).
 - Further details on the methodology applied for the wastewater surveillance can be found in [the Appendix Methodology document \(access available online\)](#).
-

¹ The wastewater surveillance is based on 30 areas.

3. Introduction

The national wastewater-based surveillance of COVID-19 started in September 2020. The present report aims to assess the wastewater-based epidemiological situation in Belgium. It is updated weekly on Tuesday based on the concentration measured in the samples during the previous week.

The SARS-CoV-2 concentrations are measured once a week in 30 wastewater treatment plants (WWTPs). The evolution of these concentrations is assessed in the present report thanks to three wastewater-based alerting indicators. The assessment is performed at 4 different spatial levels: national, regional, provincial, and the areas covered by the treatment plants.

Finally, the remaining sources of uncertainties are discussed together with their expected impacts on the interpretation of the wastewater results.

4. Methodology

4.1. SAMPLE COLLECTION AND ANALYSIS

Samples are collected once a week in several wastewater treatment plants (WWTP) covering around 38% of the Belgian population: 30% in the Flemish region, 30% in the Walloon region, and nearly 100% in the Brussels region. Figure 1 shows the catchment areas covered by the WWTP located in areas with high population density. The catchment area of a WWTP corresponds to the geographical area from which the wastewater are collected.

Samples are collected on Mondays by auto-samplers (24-hour composite) at the influent of WWTP. The analysis are distributed amongst 2 different laboratories to quantify the concentration of SARS-CoV-2 RNA. The results corresponding to the samples of the Mondays are made publicly available on the Tuesday the week after.

Further details on the coverage, sampling plan, and analytical method can be found in [the Appendix Methodology document](#)

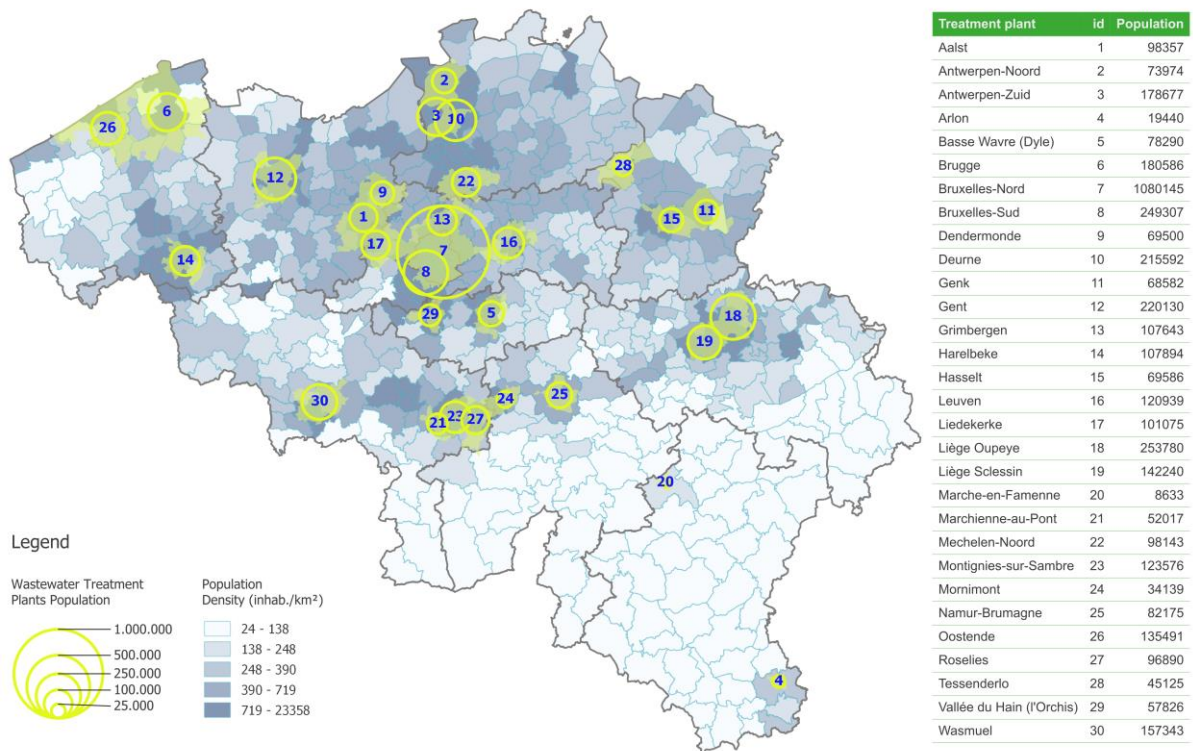


Figure 1: The population located in the areas covered by the wastewater treatment plants (highlighted in yellow) and the population density for each municipality (indicated by the blue scale). From the first January 2024 onwards, only 30 areas are covered by the surveillance.

4.2. WASTEWATER RESULTS

In order to account for possible dilution by rainy events and for the number of people living in the catchment area of each WWTP, a correction is applied on the viral concentration: the concentration is multiplied by the inlet flow and divided by the number of inhabitant of its respective WWTP and expressed by 100k inhabitant. The viral loads are expressed in copy/day/100k inhabitants.

The limit of quantification of the analytical method was estimated at 10 copies/ml.

4.3. ALERTING INDICATORS

To highlight the areas of possible concern, the three alerting indicators are assessed once a week, based on viral loads (RNA copies/day/100k inhabitants):

1. The **Increasing Trend** indicator highlights the catchment areas where the viral loads have been increasing for more than 6 days. The indicator is computed based on the moving average on the past two weeks of the viral load.
2. The **Fast Increase** indicator highlights the catchment areas where the viral loads have rapidly increased for the last week. It corresponds to a situation where the moving average on the past 7 days of the viral load has increased faster than 70% per week if being above the estimated limit of quantification. The increasing slope is normalized for each treatment plant.
3. The **High Circulation** indicator highlights the catchment areas where the viral loads are high. It corresponds to a situation where the viral loads exceed half of the highest value recorded during the ninth wave (i.e. from 21th of November 2022 till first of January 2023).

The indicators were developed to monitor the different phases of an outbreak. the indicator Increasing Trend will be on alert first in the emerging phase. If the viral loads increase quickly, the Fast Increase indicator will then turn on alert. Finally, the viral loads may be sufficiently high to result in the High Circulation indicator to turn on alert.

4.4. CAUTION POINTS FOR THE RESULTS INTERPRETATION

The viral loads should not be directly compared between catchment areas, provinces, nor regions because analyses are conducted by three different laboratories. To mitigate this bias, the indicators are computed on normalized viral loads, allowing for comparison between the different areas. Further details are available in [the methodology document \(access online\)](#).

5. Results

5.1. NATIONAL LEVEL

Table 1 shows, at the national level, the results obtained on the last sample of January 15th 2024, week 3, compared to the ones obtained on January 08th 2024. In this table, any change in indicator status (i.e. if the value for any indicator has changed from 0 to 1 or from 1 to 0) is indicated in **coloured bold text**.

The High Circulation indicator is in alert at the national level.

Table 1: Indicators in alert (1) or not (0) on January 15th 2024. Columns represent the population coverage of Belgium (Pop. coverage) and the three alerting indicators High Circulation (High), Fast Increase (Fast) and Increasing Trend (Incr.). The specifications of the four last columns are explained in the footnotes 1-4 below the table. Missing data is indicated with a “/”.

Country	Pop. coverage	High	Fast	Incr.	Norm. viral load (%) ¹	Mean viral load ²	Norm. evol. (%/week) ³	Incr. days ⁴
Belgium	38%	1	0	0	54	0.62	0.7	2

¹ : the viral load normalized with the maximum viral load measured in the corresponding catchment area during the ninth wave (i.e. from 21th of November 2022 till the first of January 2023).

² : the viral load computed on the mean of the replicate of the three targeted gene fragments as explained in section “3.2 Wastewater results”. The mean viral load is expressed in 10¹² copies/day/100k inhabitants.

³ : the slope (%/week) of the past 7 days moving average of the viral load if the corresponding concentration is above the estimated limit of quantification.

⁴ : the cumulative number of days of increase of the past 14 days moving average of the viral load.

The geographical location of the areas is presented in Figure 2 together with the status of the three indicators.

The number of areas in High Circulation is stable, with 13 areas in alert. The Increasing Trend indicator is stable, with none area in alert. Overall, the viral loads are at a high level compared to the 9th wave and stable.

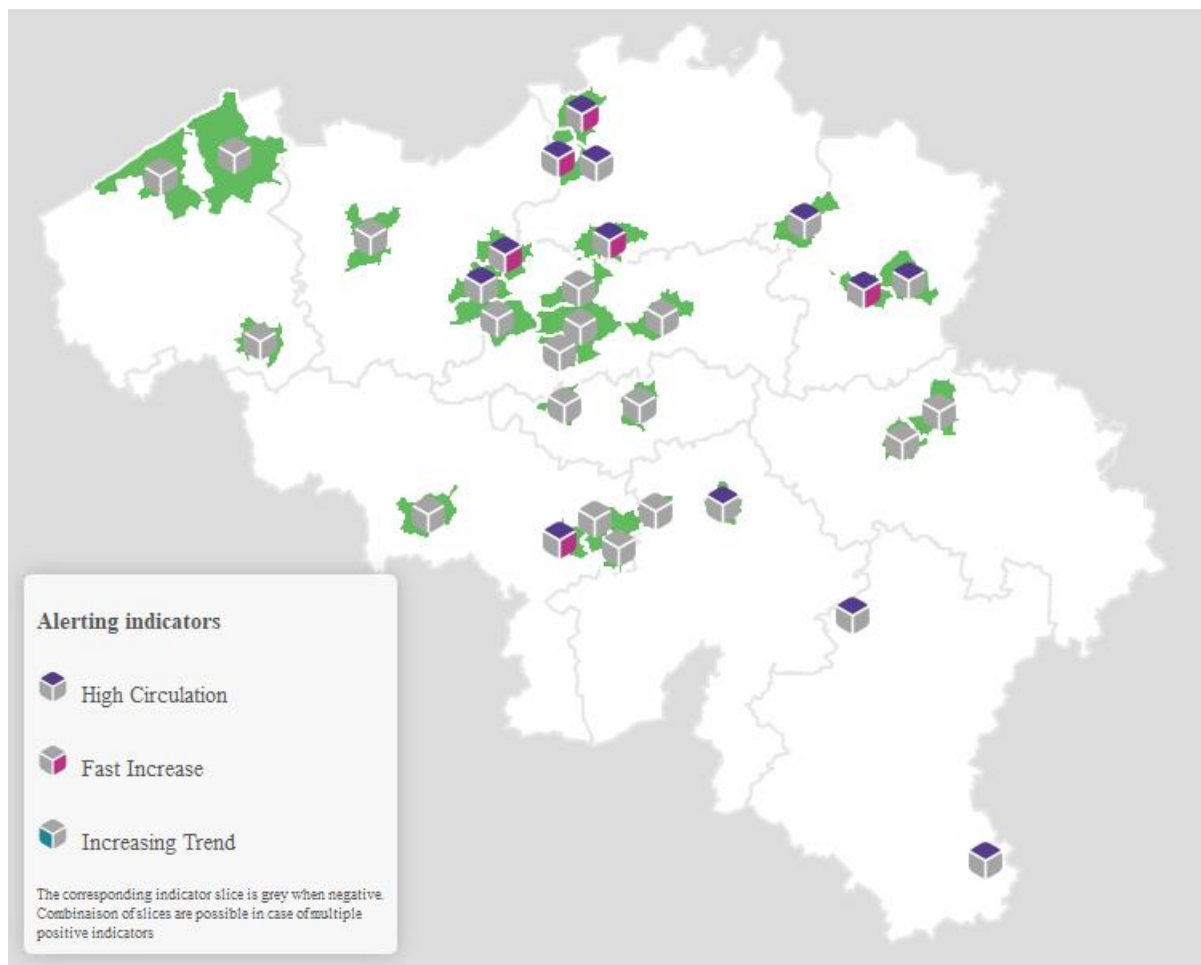


Figure 2: The geographical location of the covered areas with the corresponding status of the three alerting indicators: High circulation, Fast Increase and Increasing trend. If an indicator is in alert its corresponding slice is displayed in its colour (see legend) whereas when not in alert the same slice is greyed out. When no data is available for an area, the 3 slices are displayed in white. The names of the covered areas with respect of their localization can be found in Figure 1.

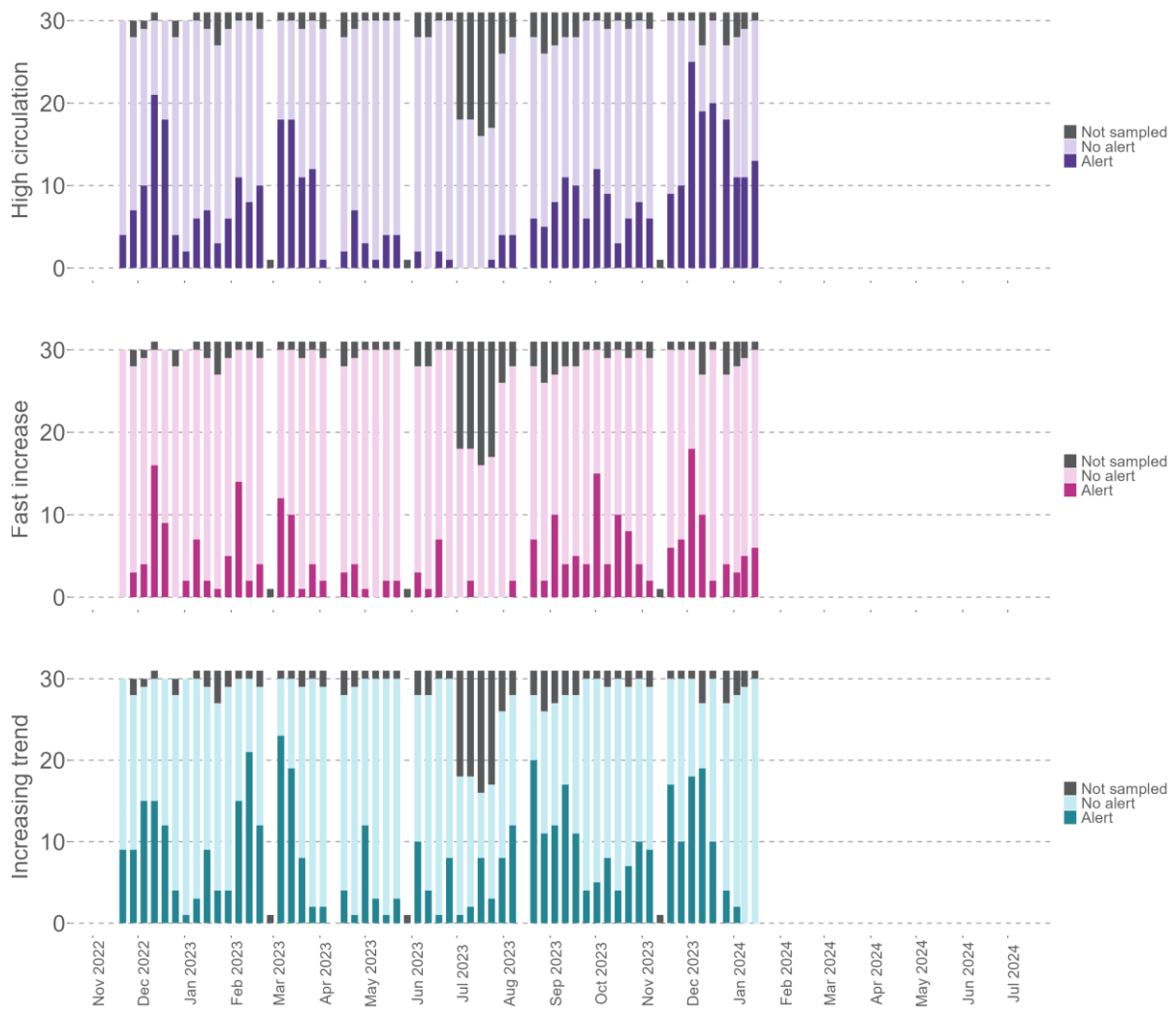


Figure 3: Number of areas having an indicator (coloured bars) in alert , number of areas having an indicator not in alert (lighter coloured bars) and number of areas not sampled (greyed out bars). Latest results correspond to January 15th 2024, week 3.

5.2. REGIONAL LEVEL

Figure 4 shows, at the regional level, the viral loads in the wastewaters.

Two waves can be seen in Figure 4:

- The 9th wave starting on 21st November 2022.
- The 10th wave starting on 23rd January 2023.

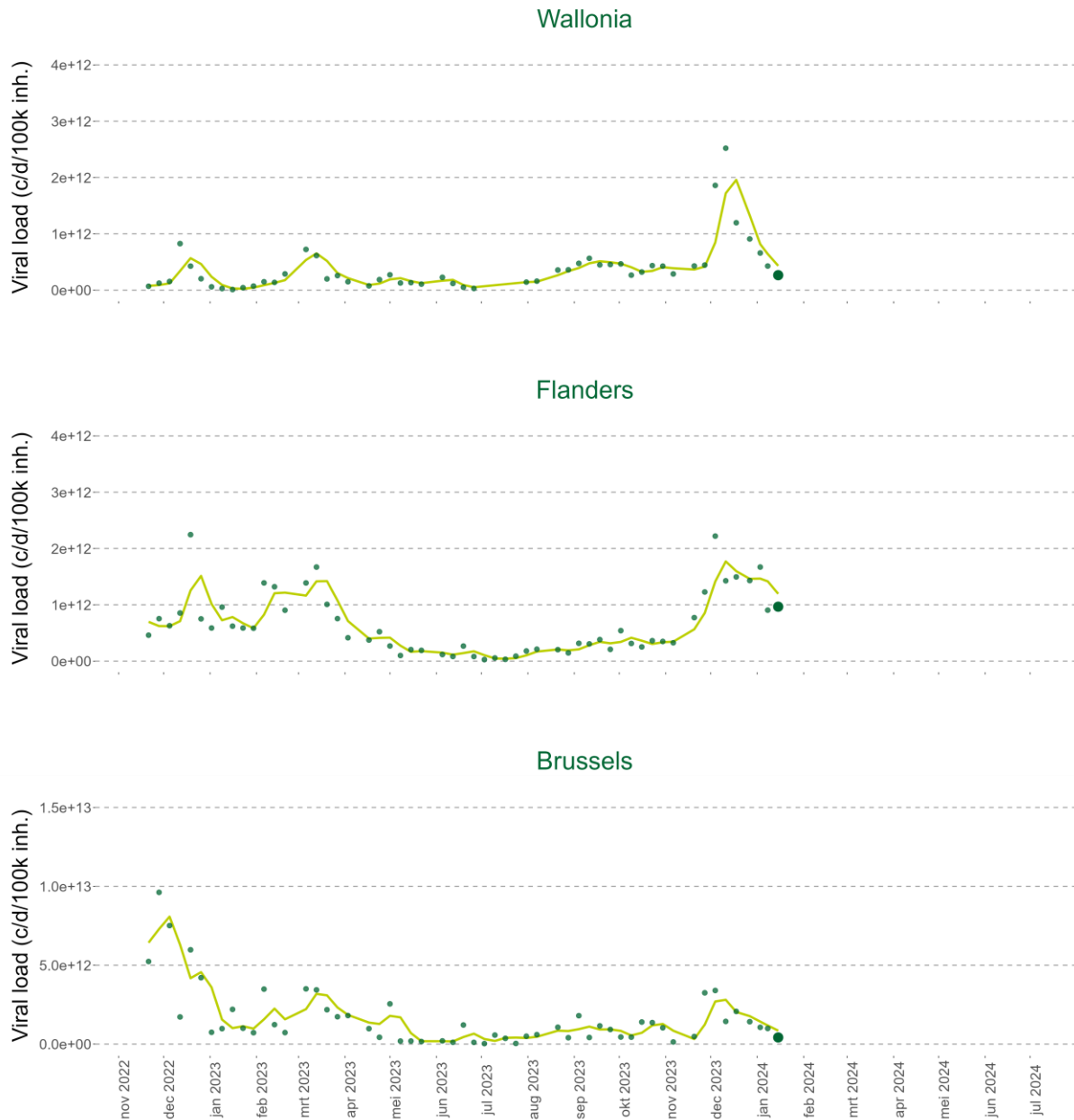


Figure 4: The SARS-CoV-2 RNA viral loads expressed as copies/days/100k inhabitants (based on the past two weeks moving average) for the three regions.

Table 2 shows, at the regional level, the results obtained on the last sample of Monday January 15th 2024, week 3. It allows to track the changes between the situation as of today (January 15th 2024) and the situation as of last week (January 08th 2024). Hereby, two distinct cases are taken into account:

1. If a region has at least one indicator in alert this week and it was not the case last week, its **name is displayed in bold** in the table.
2. If a region has at least one indicator in alert this week and if it also was the case last week, any change in indicator status (i.e. if the value for any indicator has changed from 0 to 1 or from 1 to 0) is indicated in **coloured bold text**.

The High Circulation is in alert in Flanders. None of the three indicators is in alert in Brussels and Wallonia.

Table 2: Indicators in alert (1) or not (0) on January 15th 2024. Columns represent the population coverage of the regions (Pop. coverage) and the three alerting indicators High Circulation (High), Fast Increase (Fast) and Increasing Trend (Incr.). The specifications of the four last columns are explained in the footnotes 1-4 below the table. Missing data is indicated with a “/”.

Region	Pop. coverage	High	Fast	Incr.	Norm. viral load (%) ¹	Mean viral load ²	Norm. evol. (%/week) ³	Incr. days ⁴
Brussels	100%	0	0	0	4.8	0.42	-57	1
Flanders	30%	1	0	0	101.4	0.97	41	4
Wallonia	30%	0	0	0	32.2	0.27	0	0

¹ : the viral load normalized with the maximum viral load measured in the corresponding catchment area during the ninth wave (i.e. from 21th of November 2022 till the first of January 2023).

² : the viral load computed on the mean of the replicate of the three targeted gene fragments as explained in section “3.2 Wastewater results”. The mean viral load is expressed in 10¹² copies/day/100k inhabitants.

³ : the slope (%/week) of the past 7 days moving average of the viral load if the corresponding concentration is above the estimated limit of quantification.

⁴ : the cumulative number of days of increase of the past 14 days moving average of the viral load.

5.3. PROVINCIAL LEVEL

Table 3 shows, at the provincial level, the results obtained on the last sample of Monday January 15th 2024, week 3. It allows to track the changes between the situation as of today (January 15th 2024) and the situation as of last week (January 08th 2024). Hereby, two distinct cases are taken into account:

1. If a province has at least one indicator in alert this week and it was not the case last week, its **name is displayed in bold** in the table.
2. If a province has at least one indicator in alert this week and if it also was the case last week, any change in indicator status (i.e. if the value for any indicator has changed from 0 to 1 or from 1 to 0) is indicated in **coloured bold text**.

Table 3 shows, for each Province, the results associated with the samples of Monday January 15th 2024, for the three alerting indicators:

- The Increasing Trend indicator is not in alert in any province, and was in none last week.
- The Fast Increase indicator is only in alert in the province of Antwerpen, and was in 2 provinces last week.
- The High Circulation indicator is in alert in 5 provinces: Antwerpen, Limburg, Luxembourg, Namur and Oost-Vlaanderen, and was in 5 provinces last week.

Table 3: Indicators in alert (1) or not (0) on January 15th 2024. Columns represent the population coverage of the WWTPs within the Province (Pop. coverage) and the three alerting indicators High Circulation (High), Fast Increase (Fast) and Increasing Trend (Incr.). The specifications of the four last columns are explained in the footnotes 1-4 below the table. Missing data is indicated with a “/”.

Province	Pop. coverage	High	Fast	Incr.	Norm. viral load (%) ¹	Mean viral load ²	Norm. evol. (%/w) ³	Incr. days ⁴
Antwerpen	30%	1	1	0	211.0	1.245	87	3
Brabant Wallon	33%	0	0	0	15.0	0.075	0	0
Brussels	100%	0	0	0	4.8	0.422	-57	1
Hainaut	31%	0	0	0	29.7	0.306	0	1
Liège	36%	0	0	0	26.8	0.277	0	0
Limburg	21%	1	0	0	170.4	2.015	49	8
Luxembourg	10%	1	0	0	66.8	0.624	0	0
Namur	25%	1	0	0	71.2	0.214	0	0
Oost-Vlaanderen	27%	1	0	0	71.7	0.884	35	4
Vlaams-Brabant	37%	0	0	0	17.4	0.604	-2	4
West-Vlaanderen	35%	0	0	0	17.8	0.499	0	2

¹ : the viral load normalized with the maximum viral load measured in the corresponding catchment area during the ninth wave (i.e. from 21st of November 2022 till the first of January 2023).

² : the viral load computed on the mean of the replicates of the three targeted gene fragments as explained in section “3.2 Wastewater results”. The mean viral load is expressed in 10¹² copies/day/100k inhabitants.

³ : the slope (%/week) of the past 7 days moving average of the viral load if the corresponding concentration is above the estimated limit of quantification.

⁴ : the cumulative number of days of increase of the past 14 days moving average of the viral load.

5.4. INDIVIDUAL CATCHMENT AREAS LEVEL

Table 4 shows, at the catchment area level, the results obtained on the last sample of Monday January 15th 2024, week 3. It allows to track the changes between the situation as of today (January 15th 2024) and the situation as of last week (January 08th 2024). Hereby, three distinct cases are taken into account:

1. If an area has at least one indicator in alert this week and it was not the case last week, its **name is displayed in bold** in the table.
2. If an area has at least one indicator in alert this week and if it also was the case last week, any change in indicator status (i.e. if the value for any indicator has changed from 0 to 1 or from 1 to 0) is indicated in **coloured bold text**.

Any area which had at least one indicator in alert last week but not this week is listed below Table 4.

Here are the results associated with the samples of January 15th 2024:

- The Increasing Trend indicator is not in alert in any covered area. Last week, this indicator was not in alert in any covered area.
- The Fast Increase is in alert in 6 covered areas: Mechelen-Noord (248.9% increase per week), Dendermonde (186.1% increase per week), Hasselt (124.5% increase per week), Antwerpen-Noord (110.4% increase per week), Marchienne-au-Pont (110% increase per week) and Antwerpen-Zuid (101.4% increase per week) (see Appendix A2 for more details). Last week, this indicator was in alert in 5 covered areas.
- The High Circulation indicator is in alert in 13 covered areas. The full list of these areas can be found in Appendix A1. Last week, this indicator was in alert in 11 covered areas.

The wastewater results at the level of the local covered areas can be accessed online for each area on the [COVID-19 dashboard](#).

Table 4: Indicators in alert (1) or not (0) on January 15th 2024. Columns represent the provinces, different WWTPs within the Provinces and the three alerting indicators High Circulation (High), Fast Increase (Fast) and Increasing Trend (Incr.). The specifications of the four last columns are explained in the footnotes 1-4 below the table. Missing data is indicated with a “/”.

Province	WWTP	High	Fast	Incr.	Norm. viral load (%) ¹	Mean viral load ²	Norm evol. (%/week) ³	Incr. days ⁴
Oost-Vlaanderen	Aalst	1	0	0	60.10	1.19	1.3	12
Antwerpen	Antwerpen-Noord	1	1	0	146.38	0.80	110.4	7
Antwerpen	Antwerpen-Zuid	1	1	0	274.11	1.37	101.4	0
Luxembourg	Arlon	1	0	0	64.03	0.67	15.0	0
Oost-Vlaanderen	Dendermonde	1	1	0	261.42	0.81	186.1	7
Antwerpen	Deurne	1	0	0	253.30	1.40	-7.4	0
Limburg	Genk	1	0	0	200.82	3.04	5.5	7
Limburg	Hasselt	1	1	0	214.96	2.03	124.5	7
Luxembourg	Marche-en-Famenne	1	0	0	73.15	0.51	0.0	0
Hainaut	Marchienne-au-Pont	1	1	0	63.71	1.04	110.0	7
Antwerpen	Mechelen-Noord	1	1	0	52.04	1.01	248.9	12
Namur	Namur-Brumagne	1	0	0	93.81	0.20	0.0	0
Limburg	Tessenderlo	1	0	0	55.34	0.43	0.0	12

¹ : the viral load normalized with the maximum viral load measured in the corresponding catchment area during the ninth wave (i.e. from 21th of November 2022 till the first of January 2023).

² : the viral load computed on the mean of the replicates of the three targeted gene fragments as explained in section “3.2 Wastewater results”; The mean viral load is expressed in 10¹² copies/day/100k inhabitants.

³ : the slope (%/week) of the past 7 days moving average of the viral load if the corresponding concentration is above the estimated limit of quantification.

⁴ : the cumulative number of days of increase of the past 14 days moving average of the viral load.

The following areas had the corresponding indicator in alert last week but not this week:

- Increasing Trend indicator: No area.
- Fast Increase indicator: Grimbergen, Leuven and Wasmuel.
- High Circulation indicator: Liege Oupeye and Montignies-sur-Sambre.

Further details on covered area without indicators in alert can be found in Table A4.

6. Appendix – Areas classified by indicator

Table A1: Areas for which the High Circulation indicator is in alert (13 out of 30 on January 15th 2024).

Province	WWTP	High	Fast	Incr.	Norm. viral load (%) ¹	Mean viral load ²	Norm evol. (%/week) ³	Incr. days ⁴	Date Max cc ⁵
Antwerpen	Antwerpen-Zuid	1	1	0	274.11	1.37	101.4	0	27/11/2023
Oost-Vlaanderen	Dendermonde	1	1	0	261.42	0.81	186.1	7	06/02/2023
Antwerpen	Deurne	1	0	0	253.30	1.40	-7.4	0	27/12/2023
Limburg	Hasselt	1	1	0	214.96	2.03	124.5	7	15/01/2024
Limburg	Genk	1	0	0	200.82	3.04	5.5	7	18/12/2023
Antwerpen	Antwerpen-Noord	1	1	0	146.38	0.80	110.4	7	11/12/2023
Namur	Namur-Brumagne	1	0	0	93.81	0.20	0.0	0	11/12/2023
Luxembourg	Marche-en-Famenne	1	0	0	73.15	0.51	0.0	0	04/12/2023
Luxembourg	Arlon	1	0	0	64.03	0.67	15.0	0	11/12/2023
Hainaut	Marchienne-au-Pont	1	1	0	63.71	1.04	110.0	7	11/12/2023
Oost-Vlaanderen	Aalst	1	0	0	60.10	1.19	1.3	12	17/10/2022
Limburg	Tessenderlo	1	0	0	55.34	0.43	0.0	12	11/12/2023
Antwerpen	Mechelen-Noord	1	1	0	52.04	1.01	248.9	12	9 th wave

¹ : the viral load normalized with the maximum viral load measured in the corresponding catchment area during the ninth wave (i.e. from 21st of November 2022 till the first of January 2023).

² : the viral load computed on the mean of the replicates of the three targeted gene fragments as explained in section “3.2 Wastewater results”. The mean viral load is expressed in 10¹² copies/day/100k inhabitants.

³ : the slope (%/week) of the past 7 days moving average of the viral load if the corresponding concentration is above the estimated limit of quantification.

⁴ : the cumulative number of days of increase of the past 14 days moving average of the viral load.

⁵ : date at which the measured viral load was the highest since the beginning of the ninth wave. If the date was between the 21st of November 2022 and the first of January 2023, the date is considered to be during the ninth wave and mentioned as such.

Table A2: Areas for which the Fast Increase indicator is in alert (6 out of 30 on the January 15th 2024).

Province	WWTP	High	Fast	Incr.	Norm. viral load (%) ¹	Mean viral load ²	Norm evol. (%/week) ³	Incr. days ⁴	Date Max cc ⁵
Antwerpen	Mechelen-Noord	1	1	0	52.04	1.01	248.9	12	9 th wave
Oost-Vlaanderen	Dendermonde	1	1	0	261.42	0.81	186.1	7	06/02/2023
Limburg	Hasselt	1	1	0	214.96	2.03	124.5	7	15/01/2024
Antwerpen	Antwerpen-Noord	1	1	0	146.38	0.80	110.4	7	11/12/2023
Hainaut	Marchienne-au-Pont	1	1	0	63.71	1.04	110.0	7	11/12/2023
Antwerpen	Antwerpen-Zuid	1	1	0	274.11	1.37	101.4	0	27/11/2023

¹ : the viral load normalized with the maximum viral load measured in the corresponding catchment area during the ninth wave (i.e. from 21th of November 2022 till the first of January 2023).

² : the viral load computed on the mean of the replicates of the three targeted gene fragments as explained in section “3.2 Wastewater results”. The mean viral load is expressed in 10¹² copies/day/100k inhabitants.

³ : the slope (%/week) of the past 7 days moving average of the viral load if the corresponding concentration is above the estimated limit of quantification.

⁴ : the cumulative number of days of increase of the past 14 days moving average of the viral load.

⁵ : date at which the measured viral load was the highest since the beginning of the ninth wave. If the date was between the 21th of November 2022 and the first of January 2023, the date is considered to be during the ninth wave and mentioned as such.

Table A3: Areas for which the Increasing Trend indicator is in alert (0 out of 30 on the January 15th 2024).

The Increasing Trend is not in alert in any of the areas.

Table A4: Areas for which none of the three indicators is in alert (17 out of 30 on the January 15th 2024).

Province	WWTP	High	Fast	Incr.	Norm. viral load (%) ¹	Mean viral load ²	Norm evol. (%/week) ³	Incr. days ⁴	Date Max cc ⁵
Brabant Wallon	Basse Wavre (Dyle)	0	0	0	21.82	0.10	0	0	25/09/2023
West-Vlaanderen	Brugge	0	0	0	11.29	0.51	0	0	9 th wave
Brussels	Brussels-North	0	0	0	3.82	0.42	-58.2	0	9 th wave
Brussels	Brussels-South	0	0	0	8.86	0.41	-53.9	7	17/10/2022
Oost-Vlaanderen	Gent	0	0	0	17.00	0.77	2.1	0	03/01/2024
Vlaams-Brabant	Grimbergen	0	0	0	27.55	0.52	-24.9	7	14/11/2022
West-Vlaanderen	Harelbeke	0	0	0	16.36	0.46	0	7	04/12/2023
Vlaams-Brabant	Leuven	0	0	0	2.72	0.13	0	0	04/12/2023
Vlaams-Brabant	Liedekerke	0	0	0	24.24	1.26	21.1	7	9 th wave
Liège	Liege Oupeye	0	0	0	31.60	0.27	0	0	04/12/2023
Liège	Liege Sclessin	0	0	0	18.30	0.29	15.5	0	04/12/2023
Hainaut	Montignies-sur-Sambre	0	0	0	46.37	0.34	0	0	11/12/2023
Namur	Mornimont	0	0	0	16.60	0.26	0	0	11/12/2023
West-Vlaanderen	Oostende	0	0	0	27.47	0.51	/	0	03/01/2024
Hainaut	Roselies	0	0	0	25.47	0.25	0	0	11/12/2023
Brabant Wallon	Vallee du Hain (L'Orchis)	0	0	0	5.70	0.03	0	0	11/12/2023
Hainaut	Wasmuel	0	0	0	7.94	0.07	0	0	11/12/2023

¹ : the viral load normalized with the maximum viral load measured in the corresponding catchment area during the ninth wave (i.e. from 21th of November 2022 till the first of January 2023).

² : the viral load computed on the mean of the replicates of the three targeted gene fragments as explained in section "3.2 Wastewater results". The mean viral load is expressed in 10¹² copies/day/100k inhabitants.

³ : the slope (%/week) of the past 7 days moving average of the viral load if the corresponding concentration is above the estimated limit of quantification.

⁴ : the cumulative number of days of increase of the past 14 days moving average of the viral load.

⁵ : date at which the measured viral load was the highest since the beginning of the ninth wave. If the date was between the 21th of November 2022 and the first of January 2023, the date is considered to be during the ninth wave and mentioned as such.