



Q1. Veolia & Covid-19 pandemic

- * How Veolia as a water company facing COVID-19-related issues?
- * What were the business impact of Covid 19 for the Water company like Veolia



ACKNOWLEDGEMENT



Partners & Veolia BUs WW... and more coming soon

































"No one can whistle a symphony. It takes a whole orchestra to play it." H.E. Luccock



Many thanks to European Commission, the different authorities and especially **to Bernd Manfred Gawlik**, European Commission, DG Joint Research Centre

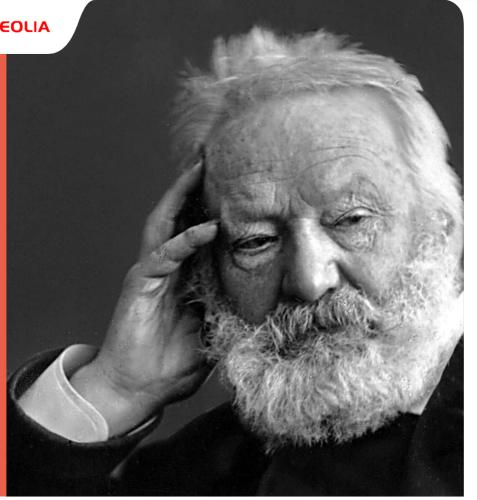


Back to the Sewer

"The sewer is the conscience of the city. Everything there converges and confronts everything else. In that livid spot there are shades, but there are no longer any secrets."

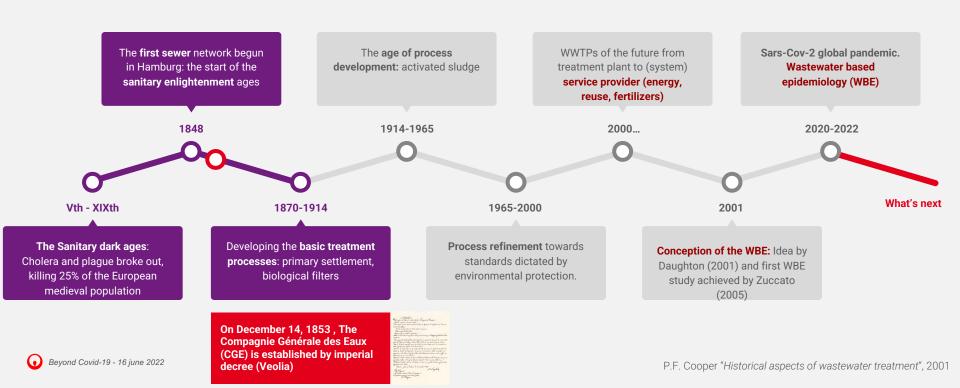
Victor Hugo

The Intestine of Leviathan, Les Misérables (1862)



THE SANITATION TIMELINE

The history of wastewater treatment through the ages



THE COVID-19 and VEOLIA activities Veolia Purpose, the essentials services and workers protection

What is Veolia's mission during the crisis?

Veolia's mission is to deliver essential water, waste and energy services on a daily basis. From the outset of the pandemic, we rolled out continuity plans for these services in our different zones and for our various businesses. Our employees are prepared and dedicated to maintaining these services for the public, healthcare establishments and vital businesses (food processing, supermarkets, energy suppliers, etc.), all of which rely on us to continue to provide their services on a daily basis.



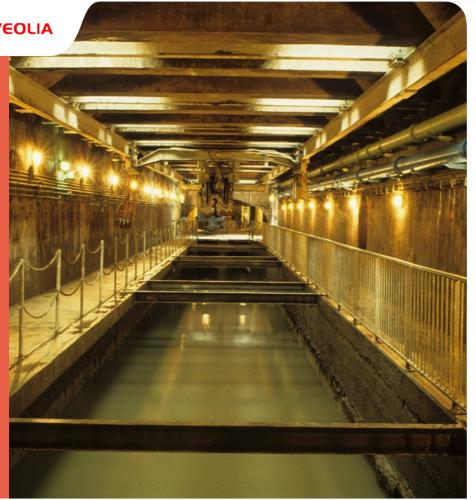
What are the priorities during the pandemic for WATER sector?

Our priorities are the essential operations: ensuring drinking water production and wastewater treatment. Some operations, such as non-emergency maintenance operations or meter readings, have been postponed.



Q2. Science, **Technology, Innovation** in the time of Covid-19

What are the technological innovations you have developed to handle this new environmental issue? Lessons learned?



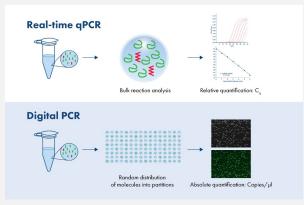


Science, Technology and Innovation in the time of Covid-19 Lab Automation & Digitalization



From RTqPCR to dPCR







Qiagen website

Test of on-site equipments

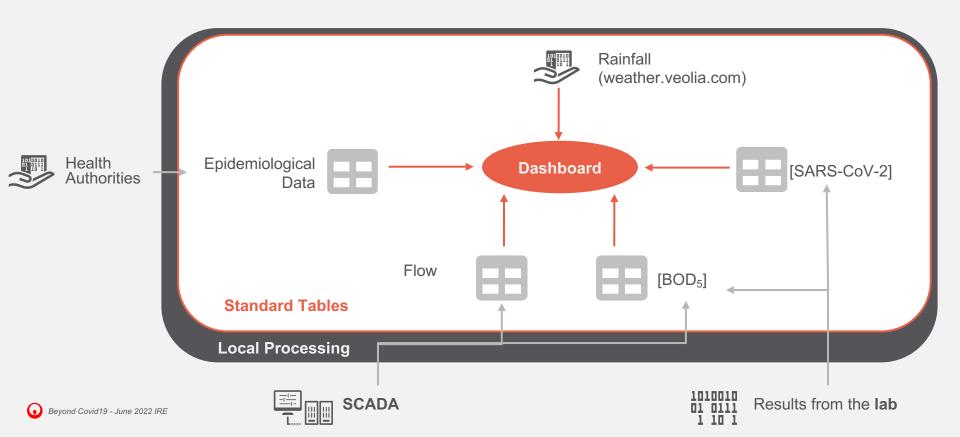






Science, Technology and Innovation in the time of Covid-19 Data Transfer & Dashboarding Automation





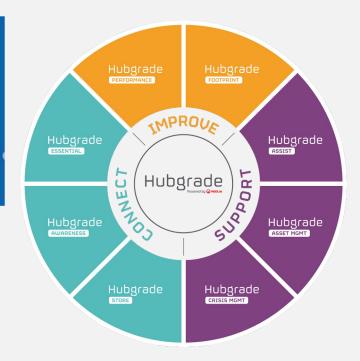


Science, Technology and Innovation in the time of Covid-19 HUBGRADE, Veolia Digital Solutions











Science, Technology and Innovation in the time of Covid-19

Promising future...NGS, Data the new Oil, Sensors, Technos transfer, "Global Innovation Partnerships"... but also "operational" and costeffective



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Next Sequencing Generation NGS Technology for a new vision of the WCE/WBE(sewer) as an "One Health" Observatory

- o Detection of unknown & unexpected virus biomarkers, check for sequence stability, Identify new variants
- Selection of reliable biomarkers for routine monitoring (PCR detection)
- But mainly available for R&D purposes, need highly skilled people & human health experts, too expensive for routine monitoring.

LEVEL 2 LEVEL 1 LEVEL 3 **Biomarker Public Health** Selected biomarker presence **Broad Range DNA/RNA** identification **Outbreak Dynamics/Incidence** authorities detection (on/off) **NGS** analyses communication & selection monitorina (quantitative) Self surveillance monitoring of o Detect unknown & unexpected selected biomarkers virus biomarkers o Dynamic monitoring campaign o Traffic light (pathogenic virus o Check sequence stability o Full regional epidemiological detection) o Identify new variants analysis of the spatiotemporal o Baseline change outbreak

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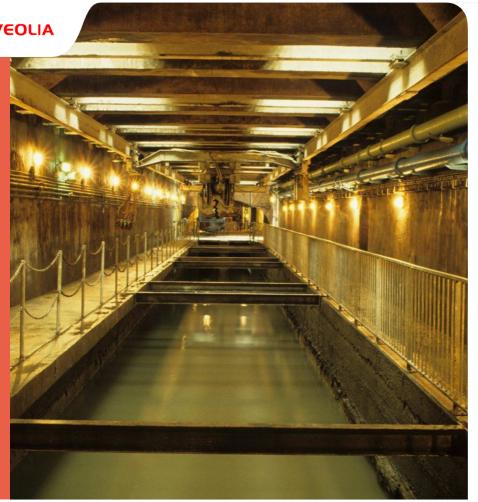
Beyond Covid19 - June 2022 IRE



Q3. Broaden the scope

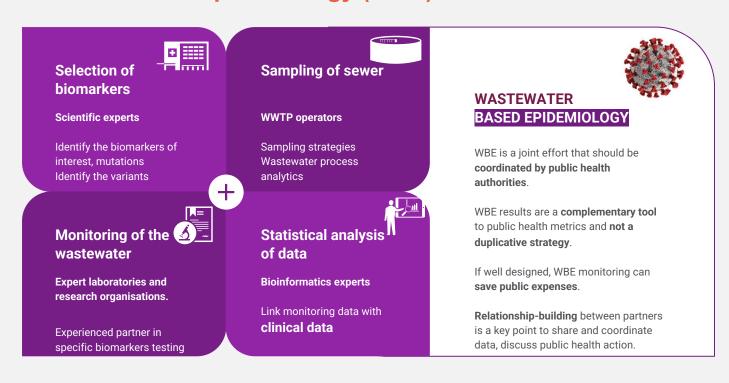
Broaden the scope of the methodology to other targets and to the water cycle => Water Cycle Epidemiology

How you are getting ready for the next epidemic?



BEYOND COVID-19

WasteWater Based Epidemiology (WBE) - Lessons from the Covid-19



BEYOND THE COVID-19 THE KEY QUESTIONS

What could the next pandemic be? What could be the next pathogens?











Which detection and monitoring approaches for Early Warning and monitoring infectious disease spread and chemicals?

- Next generation sequencing NGS approaches
- Electrochemical, antibody-based sensor, biosensors
- In silico Prediction Models

BEYOND COVID-19 THE FUTURE OF ENVIRONMENTAL MONITORING

level 1

Event Detection (On/Off)



Environmental surveillance of selected chemical and biological biomarkers

- High frequency monitoring
- Simple routine monitoring methods
- Defined biomarkers (chemicals, AMR, pathogens, ...)
- and/or disease detection)

level 2

Outbreak Dynamics



Epidemiology of the outbreak: translate environmental monitoring data into public health metrics

level 3

Non target WBE screening

Non target regular environmental surveillance Identification of new biomarkers

- Traffic light strategy (baseline change

- Positive sample at level 1=> T0
- Alert Health authorities
- Dynamic monitoring campaigns
- A full regional epidemiological analysis of the spatiotemporal outbreak

- Regular long term monitoring
- New variant sequencing
- Monitoring of baseline change of unknown biomarkers
- Identification of unknown biomarkers



WBE

An indicator of public health

Exposure to harmful chemicals

Endocrine substances, pesticides, flame retardants, PFAS, ...

Pathogens

Sars-Cov-2. Poliovirus. Influenza A, Enterococcus, Norovirus, etc.



GLOBAL

INITIATIVE



Antimicrobiol resistance (AMR)

Antibiotic resistant genes



Caffeine, vitamins, mycotoxins, isoflavones, oxidative stress biomarkers



score

Illicit drugs & new psychoactive substances

Cocaine, amphetamine, heroin, methcathinone, methoxetamine, PMA



Smoking and alcohol

Nicotine, cotinine, anatibine, anabasine



Drugs use

Biomarkers of intervention,, biomarkers of inflammation, overthe-counter medicines



Atenolol, carbamazepine, metformin, oxypurinol,, obesity biomarkers



Bevond Covid-19 - 16 iune 2022

adapted from RIVM

WATER CYCLE EPIDEMIOLOGY, WCE

The indicator of "THE OSH"



- Raw wastewater: WBE for human health and AMR
- Treated wastewater: WCE for environmental health/resources protection
- Surface water: WCE for human, animal & environmental health



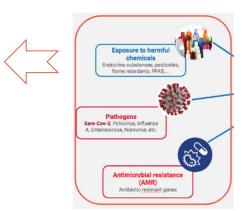
WATER SAFETY PLAN and SANITATION SAFETY PLAN

The tool to manage the next steps?

Health Protection: Risk management













- 1 WBE & AMR
- WCE environmental risk
- WCE- health risk

WATER SAFETY PLAN and SANITATION SAFETY PLAN

The tool to manage the next steps?



Protection of Public Health through risk prevention



Source: WHO



Source: WHO 2015

Ensure safe use of human waste

Ensure safe drinking water



VEOLIA

Assembling existing bricks, **Bridging** experts



CONCLUSIONS& Perspectives

- → Sars-Cov 2 pandemic accelerated our preparedness to the use of WBE, the digitalisation and the cooperation between public and private
- → Prioritisation of targeted markers/biomarkers is needed
- → A successful coordination/communication between partners is a key point
- Municipalities/Cities should have a defined role
- → There are existing bricks but research gaps remain
- → This research cannot be done by one isolated entity

But how to duplicate this to low income countries with no sanitation systems?



RESEARCH NEEDS

Multidisciplinary expertises

WBE and/or WCE need to make bridges between multidisciplinary experts

Some bricks already exist, other (marked with*) need to be developed for WBE/WCE purposes

	Sampling strategies WWTP	Sampling strategies in the sewer *	Laboratory monitoring techniques	On-site sensing *
	Biomarkers and trigger values *	Chemical targeted and non targeted monitoring	Scientific experts (AMR, Pathogens, Chemicals)	Mathematical modelling & Statistics *
I Co	Health Experts	Coordinated communication *	Ethical guidelines *	Biological targeted and non targeted monitoring



RESEARCH NEEDS

Multidisciplinary expertises

How to build an **International** co-operation **Public & Private** for piecing & tracking **together** the next pandemic and also **the chemicals contamination** through Covid-19 lessons learned?



"In 20 years, we will probably use half of the solutions that do not yet exist today for the Ecological Transformation. Our project aims to create these solutions together" - Antoine Frerot

From R&I Approaches to **Policy** and the reality of **Operations** of the **Water Plant** for getting ready... *Next time!*

REGULATIONS & STANDARDS NEEDS

Authorities Responsibilities - Public & Private ressources!

From R&I Approaches to **Policy** and the reality of **Operations** of the **Water Plant** for getting ready... *Next time!*

Policy change?

Who pays?
Water model price for health prevention?

Impact?