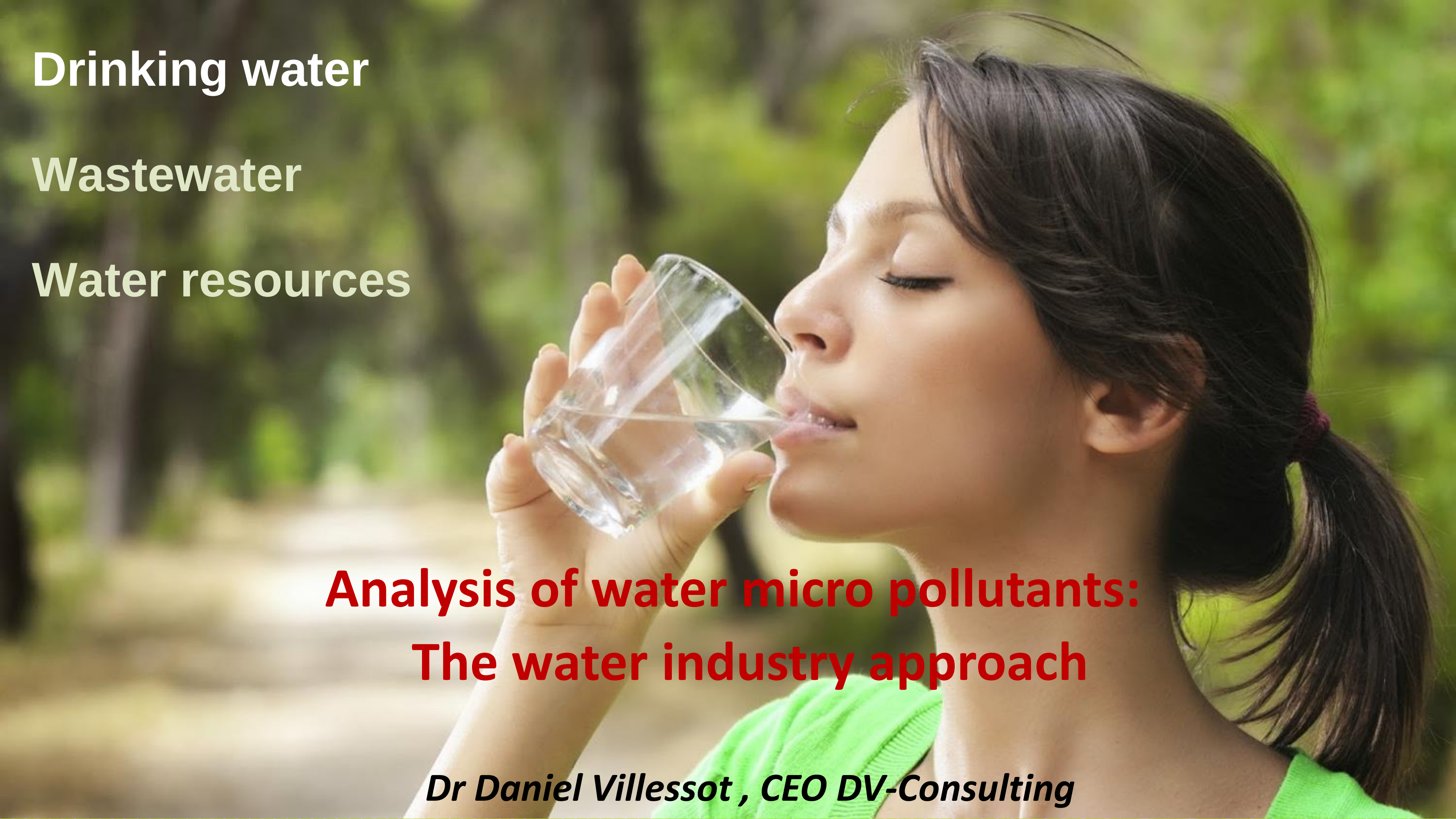


Drinking water

Wastewater

Water resources

Analysis of water micro pollutants: The water industry approach

Dr Daniel Villessot , CEO DV-Consulting

CONTENT OF THE PRESENTATION

ANALYSIS OF WATER MICROPOLLUTANTS
THE INDUSTRY APPROACH

1. DRINKING WATER QUALITY APPROACH: Regulation & Customer Satisfaction

2. THE INDUSTRY APPROACH: Real Time Water Quality Monitoring From Source To Tap

3. WATER RESSOURCES MONITORING: Water Quality Monitoring R&D+I Requirements

1. DRINKING WATER QUALITY MONITORING

- **The Necessary Control From Governmental Agencies**
- **The Surveillance And Monitoring From The Water Companies**

Drinking water is seen as of good quality, and most of consumers are confident and satisfied by its quality

(at least in France …)

24%

French consumers aren't satisfied…

53%	24%	20%
taste	**hardness**	**quality**

But 16 millions consumers are still to be satisfy

*Source : baromètre 21ème édition – enquête nationale 2017 – Centre d'Information sur l'Eau

Taste

53%

Taste

Tastes identified

- **Earth, moldy**
- **Drugs**
- **Chlorine**

OM & NOM

Chlorination

Sources

Other Water Quality issues of concerns

20% Quality

Antibio Resistent Bacterias

Nitrates

Reagents for water treatments Al, Cl,…

Polluted ressources

Micro pollutants endocrine disruptors (médicaments, hormones, pesticides, perchlorates …..)

Malicious actions etc..

Well known issues

« Emerging » topics

The water industry: a regulation driven industry

The performance and reliability of drinking water distribution systems are key factors under the responsibility of Local Authorities, their Partners and Government

The regulation framework is more and more constraining

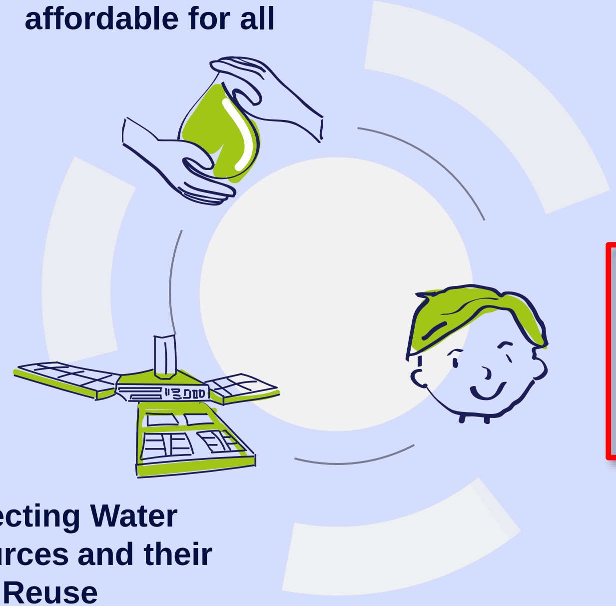
1. The European directive for drinking water quality is under revision (2019)
2. Water Safety Plan are established from source to tap to reach an overall strategy for risk monitoring and management
3. National regulations have to be adjusted to European ones
4. Water companies, public or private , have to anticipate and set prepared

2. The industry approach

An integrated approach far from the Petri dishes and Lab analysis… to AI tools, crossing microfluidics, online sensors, etc… but with always R&D+I needs

Drinking Water Quality available and affordable for all

Providing Water services and technologies for better Water Quality
From source to tap



Protecting Water Ressources and their Reuse

Providing better quality monitoring and management including AI tools

Drinking Water Quality Monitoring:

a 3 steps approach guided by performance analysis

1 Risk identification, optimization of deployment and efficiency

2 Field implementation and maintenance of equipment

3 Data collection and management

SMART WATER QUALITY MONITORING REQUIRES
(Expertise And Savoir-faire For Flexible And Robust Solutions)

Preliminary Assessment Of Sensors

Eg « SUEZ Sensor Lab »

- Leading edge technologies are field tested by Sensor Lab
- Sensors and technologies are tested with manufacturers: EFS, Intellisonde, Hach, S::Can, Bürkert, Grundfos, ITC, ….

Market opportunities & R&D+I

Some equipment already tested

- PIPE S::Can : multi parameter probe (physical & chemical)
- Bacmon: bacteria multi-parameter meter
- Micro turbines SAVE : for autonomous energy production for sensors
- Kits for bacteriological pollution detection

Savoir Faire

- Preliminary studies for assessing number and position of sensors
- Implementation and O&M of sensors
- Mapping
- Identification of events
- Data collection and event management

Real time monitoring of physico & chemical parameters on line

(main characteristics)

- ✓ **Inserted probe with field technology and Sanitary agreement**
- ✓ **Up to 7 parameters : Cl, pH, Cond, T°, UV254, turbidity, TOC**
- ✓ **Many sites in France**
- ✓ **Compatible with most of supervisors**
- ✓ **Low Maintenance (every 6 months)**

Cutting-edge technology for on line bacteria counting

Compteur de particules

10 sec – 1 min

Pas de différenciation dans la nature des particules

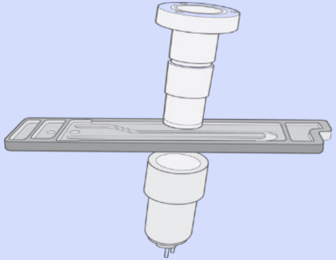
GRUNDFOS BACMON

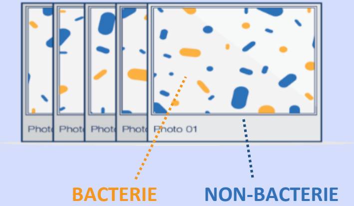
5 min – 15 min

Analyse de cultures en laboratoire traditionnelle

De 3h à 3 jours

Délais incompatibles pour une réactivité temps réel en cas de risque avéré





- Scan optique des particules
- Analyse 3D des images
- Identification de la quantité de bactérie / ml

Other market approaches

- Modular set of sensors on palatines offering rapid plug and play option (E+H)
- Microfluidic technologies and Lab on chip approaches (Klearia)
- Mainly for the water treatment plants and water resources monitoring; needs also for random field sampling & analysis (fluidion)
- State-of-the-art communication interfaces and protocols to integrate devices into process (AI)

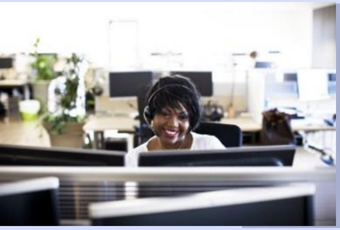
Real time monitoring of water quality from source to tap

Operational efficiency, responsiveness and prioritization of actions

90% of disturbances detected as upstream as possible

Network efficiency

+ 2 to 5% on leakage and up to 15% on energy consumption

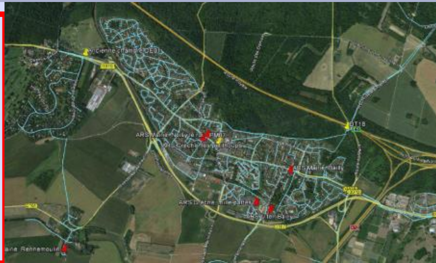


Improving the quality of services to consumers

Minimizing the delays and disturbances due to civil works and repairs

Drinking water quality

Real time monitoring of the quality of distributed drinking water regarding physical, chemical and bacteriological parameters

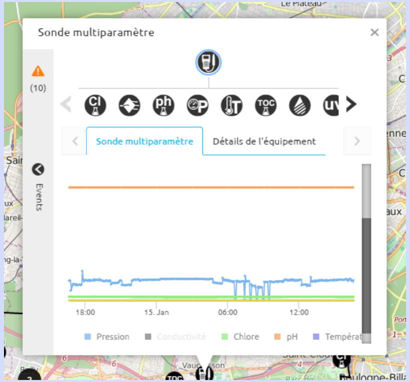


Monitoring and management of water quality under production and distribution

Mapping of water quality

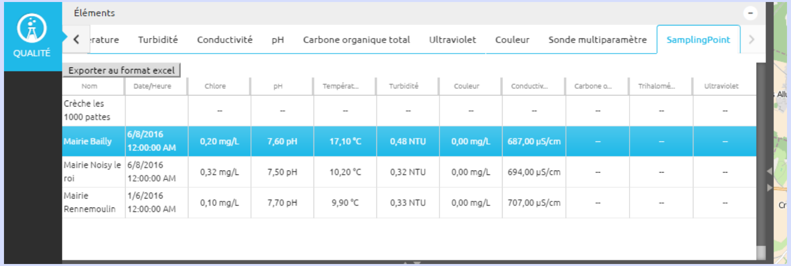
Monitoring of events linked to water quality

- Detection of events based on historic algorithm of quality
- Characterisation of events

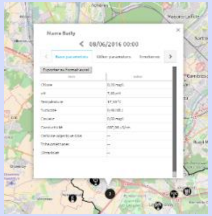


Management of sampling points

- Mapping of sampling points leading to the LIMS
- Data collection and management



Nom	Date/Heure	Chlore	pH	Températ...	Turbidité	Couleur	Conductiv...	Carbone o...	Trihalomé...	Ultraviolet
Crèche les 1000 pattes		--	--	--	--	--	--	--	--	--
Mairie Bailly	6/8/2016 12:00:00 AM	0,20 mg/L	7,60 pH	17,10 °C	0,48 NTU	0,00 mg/L	687,00 µS/cm	--	--	--
Mairie Noisy le roi	6/8/2016 12:00:00 AM	0,32 mg/L	7,50 pH	10,20 °C	0,32 NTU	0,00 mg/L	694,00 µS/cm	--	--	--
Mairie Rennemoulin	1/6/2016 12:00:00 AM	0,10 mg/L	7,70 pH	9,90 °C	0,33 NTU	0,00 mg/L	707,00 µS/cm	--	--	--



Monitoring of water quality using hydraulic modelling

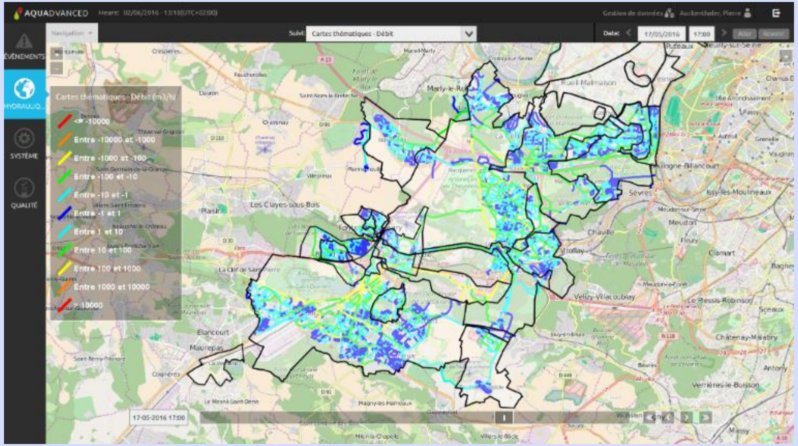
Comparison between theoretical and actual pressures and flows

Mapping of hydraulic characteristics

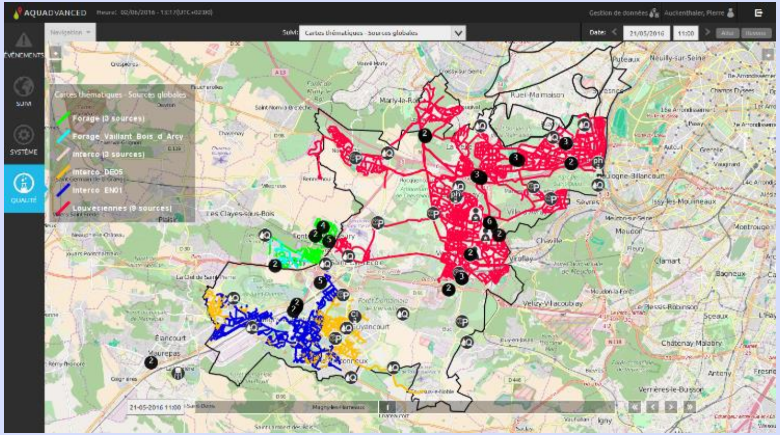
- Water velocity and flow
- Pressures and head losses,

Mapping of water qualities

- Mapping for each source of water
- Area of influence from a reservoir
- Detention time



Mapping of flows



Mapping of water sources

Smart monitoring of drinking water quality

Data mining, identification of unusual parametric values, real time monitoring and management of quality

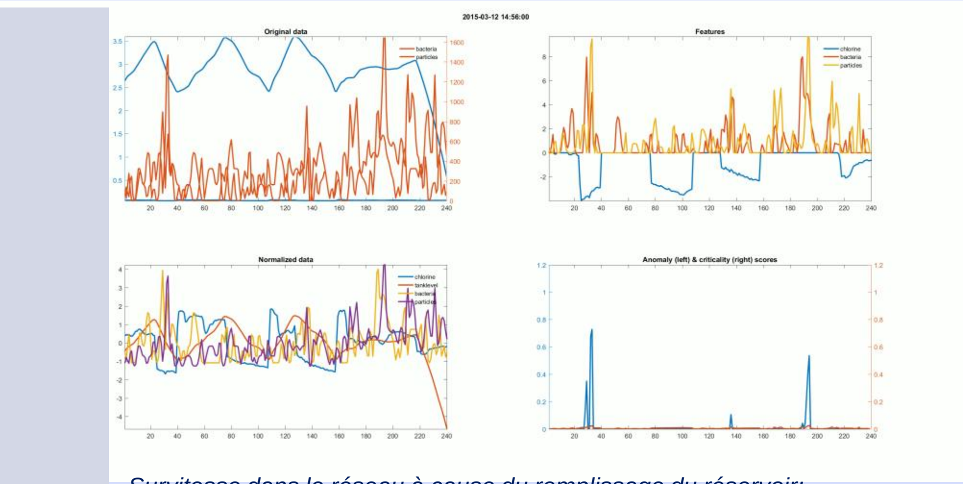
Detection of unusual quality of water

Due for example to::

- Changes in raw water quality/ different sources due to pressure
- over velocity
- Bacterial regrowth
- Corrosion / color
- criticity Indicators according to intensity

From the hydraulic model, defining of critical area

Historical registration through human expertise and machine learning



Survitesse dans le réseau à cause du remplissage du réservoir: visualisation de la détection toutes les 10 minutes

3. Water Ressources Quality Monitoring

Some trends

- ***Fluidion:*** aquatic drone for sampling and bacteria analysis from the shore (sea water) or the river bank
- **PROFILOMIC:** targeted approach on 850 micro-pollutants, online solid phase extracted (SPE first step) coupled to HPLC and mass spectroscopy high resolution
- ***Klearia:*** sensors based on microfluidic and microchips

Some needs

- From industries: extraction, oil & gas,
- From European regulation: DWD, BWD, WWD, Sludge directive
- From national regulation: pesticides, Cr, Ni, As, Cd, Se, etc.

Water Quality Monitoring Requirements

- **Development of specific sensors per element or molecule:**
- As, Cr, Cd, Hg, Se, ….
- Glyphosate, AMPA, PFOS,
- Follow-up of the next coming regulations at European or worldwide levels
- Microbiology *E. Coli., SF, Legionella,…*

- **Performance,** adapted to field conditions: energy, robustness, specificity, accuracy, corrosion, IoT,…AND

- **Cost effectiveness!**

- **Development of platforms or analytical connected units:**
- State-of-the-art communication interfaces and protocols

- **For new micro pollutants but also for older ones!** *(DDT, triazines, …)*

Water Quality Monitoring Trends

- **Some trends issued from POLLUTEC innovations 2018 and +…**

- **Development of smart* sensors per element or molecule:**
- AquaTROLL 500 (SDEC France): multi-parameter sensor
- Bürkert 8905: new sensors for ClO_2 and Fe
- SIGRIST Photometer : microbiology by flux cytometry
- C4Hydro: Legionella after 48h instead of…
- SIGMA-ALDRICH-MERCX: Spectroquant prove 600
- …

- **Development of platforms or software for micro-pollutant control:**
- Antéa: Lyxea-Redtox decision aid software
- SUEZ Smart Systems: Optimatics & Optimizer software
- …
- *** smart = self-calibration, cleaning ability, AI for O&M,…**

Water Quality Monitoring Trends

- **Smart-IoT enabled and digitalized sustainable solutions are key growth factors in the water industry facing needs for:**
- Increasing stress of water resources across the globe
- New water quality & energy monitoring from source to trap
- New communication technologies towards Clients and Users
- Explore AI and robotic solutions for process control, asset management, O&M
- Along with transitioning to sustainable business models!

Thanks for your attention

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The water industry approach

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