Createch intelligent control solutions 360°

CASE STUDY

Medium plant for nutrients removal

SANT FRUITÓS DE BAGES - NAVARCLES - SANTPEDOR WWTP (Spain)

Createch360° provides an operational intelligence platform for water and wastewater facilities that supports smart monitoring, advanced process control and decision making to reduce operational costs, enhance reliability and achieve quality consent limits.

With over 150 installations implemented by our teams worldwide, experience and continuous innovation guarantees high added-value solutions enabling utilities and industrial users to achieve maximum efficiency and best performance.

SUMMARY

Plant features

- Medium plant
- Plug-flow configuration
- Blowers + reg. valves
- Nutrient removal

Challenge

- To ensure effluent quality
- To optimize and monitor treatment performance
- To reduce aeration costs

Results

- **100%** quality compliance, despite a **30%** increase of TN treated load
- **48%** reduction of kWh/kgTN removed
- **15%** reduction of kWh/m^3

PLANT CHARACTERISTICS

This municipal wastewater treatment plant (WWTP) is located NE of Spain, was operating at half the design flow capacity, and with consented industrial discharge leading to high nitrogen inlet loads. The WWTP generally operates with one of the two biological treatment lines, equipped with an independent aeration system with blowers and automatic regulation valves, previously operated with a fixed DO setpoint control strategy. Historically, the plant was not able to reach the discharge limits in terms of total nitrogen, especially during winter periods because of limited nitrification capacity. ACA, the Catalan Water Authority, finances improvement projects such as this, and to achieve compliance, Aigües de Manresa decided to install CREA control platform to optimize the control of aeration system, internal recirculation and also biomass levels. As presented below, the results of the control platform have not only allowed to fully meet the quality requirements imposed, but have also improved the overall operation, increasing treatment capacity and energy efficiency, as well as improving the biomass stability and quality.

- **Design Flow:** 16.000 m^3/d
- **Biological treatment:**
  - 2x plug-flow reactors
- **Aeration system:**
  - 2+2+1R x blowers with VSDs
  - Automatic regulation valves
  - Airflow and pressure meters
- **Effluent discharge consent:**
  - BOD_5 < 25 mgO_2/L
  - COD < 125 mgO_2/L
  - TSS < 35 mg/L
  - TN < 15 mgN/L
  - TP < 2 mgP/L
- **Measurement equipment:**
  - DO in bioreactors
  - Airflow and pressure meters
  - N-NH_4^+ ion-selective probe
  - N-NO_3^- ion-selective probe
  - MLSS optic probe.

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CREApro® PLATFORM - CONTROL MODULES IMPLEMENTED

N-CONTROL (including intermittent aeration cycles)

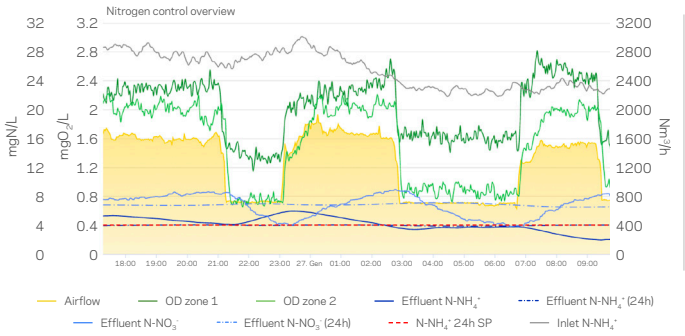
The control module is based on **N-NH_4^+**, **N-NO_3^- and DO** and includes:

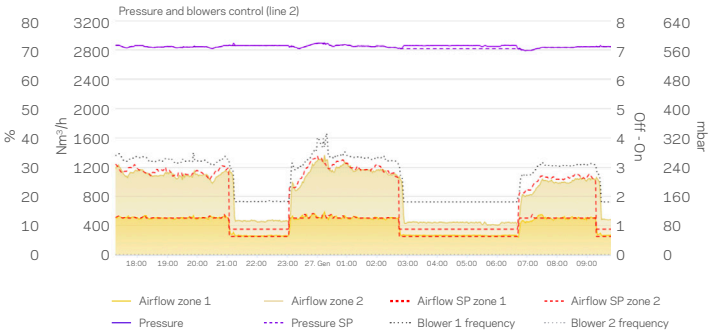
a) **Dynamyc DO setpoint strategy** to optimize oxygen demand.
b) **Dynamic NH_4 setpoint strategy** to ensure effluent quality requirements are achieved.
c) **Intermittent aeration cycles** to ensure an optimized balance of nitrification and denitrification processes.
d) **Energy cost consideration** to displace energy consumption peaks to increase monetary savings.

MOV-CONTROL (Most-Open-Valve and Pressure control)

This module is based on **DO, Airflow and Pressure** and includes:

a) **Most Open Valve strategy** to reach the target airflow to achieve the desired DO setpoint.
b) **Dynamic pressure control** to ensure maximum aeration system efficiency.
c) **Dynamic blowers control** to ensure most efficient working frequency and performance.
d) **Advanced blowers management** with different safety factors and rotation criteria.

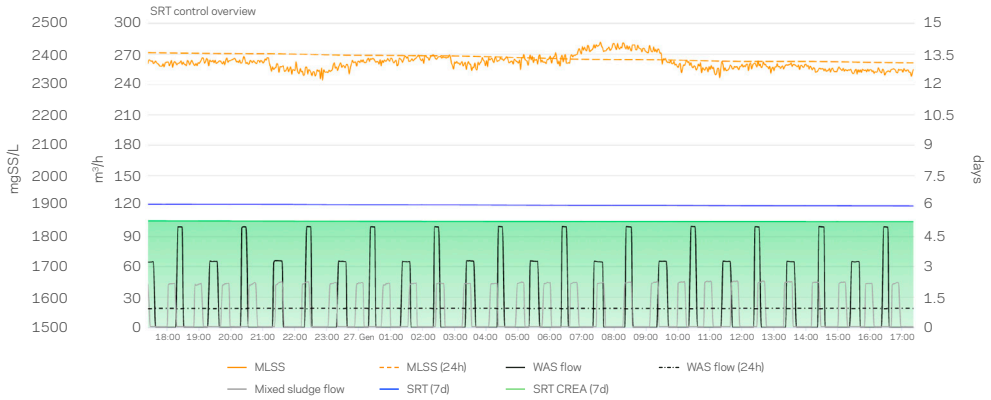




SRT-CONTROL (Sludge Residence Time control)

This module is based on **DO, N-NH_4^+, Temperature, MLSS and Waste Activated Sludge (WAS) mass** and includes:

a) **Calculation of SRT and SRT required** to ensure sufficient treatment capacity at minimum energy costs.
b) **SRT control mode** to maintain a calculated or selected SRT.
c) **MLSS control mode** to maintain a desired MLSS in the biological treatment.
d) **WAS mode** to maintain a desired sludge flow-rate or time-based operation.
e) **Safety factors** levels to ensure slow changes to the process.



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RESULTS

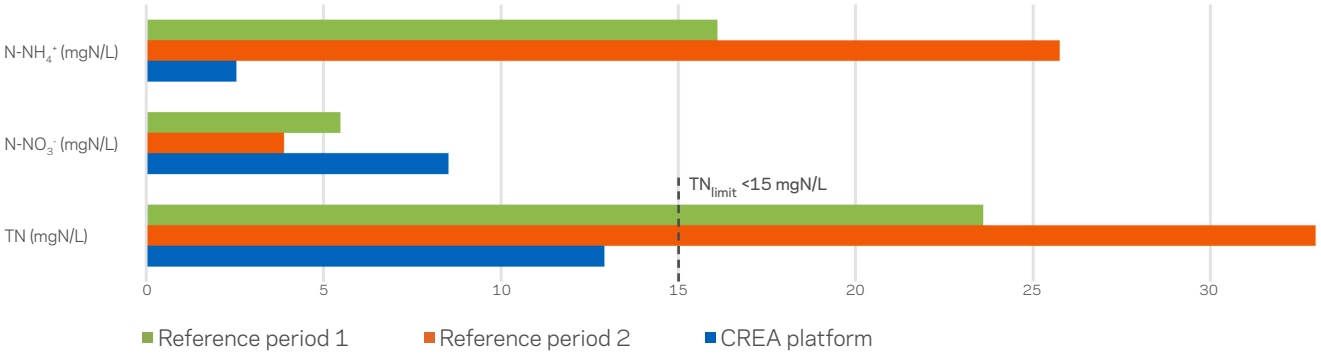
This section presents the differences between a reference period 1 (1st January – 1st April 2019), period 2 (1st November 2019 – 1st April 2020) and period running with the CREApro® control platform (1st November 2020 – 1st April 2021).

Inlet load

	Reference period 1	Reference period 2	CREA platform	Difference
Treated flow (m^3 / day)	4.761	5.086	6.547	+38% // +29%
Treated load (kgN-NH_4^+ / day)	201	242	284	+41% // +17%
Treated load (kgTN / day)	280	339	443	+58% // +30%

Data provided by the client; Aigües de Manresa.

Effluent quality (nitrogen)



Data provided by the client; Aigües de Manresa.

Process performance

	Reference period 1	Reference period 2	CREApro®	Difference
NH_4 removed kgN-NH_4^+ / day - %)	125 / 59%	117 / 46%	309 / 95%	+146% / +61% // +164% / +105%
TN removed (kgTN / day - %)	164 / 57%	192 / 55%	359 / 80%	+119% / +41% // +87% / +55%
V30 - IVF	771 / 266	1.013 / 389	607 / 236	-21% -11% // -40% -39%

Data provided by the client; Aigües de Manresa.

Energy and sustainability KPIs

	Reference period 1	Reference period 2	CREApro®	Difference
kWh / m^3	0,57	0,47	0,4	-30% // -15%
kWh / kgN-NH_4^+ removed	24,6	17,2	8,8	-64% // -49%
kWh / kgTN removed	23,3	16,4	8,5	-63% // -48%

Data provided by the client; Aigües de Manresa.

100% Effluent quality compliance

30% Increase of TN treated load

15% Reduction of kWh/m^3

48% Reduction of kWh/kgTN removed

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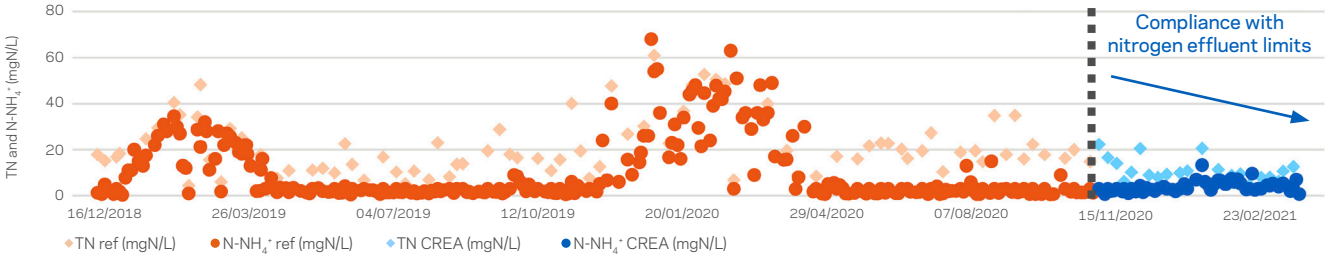
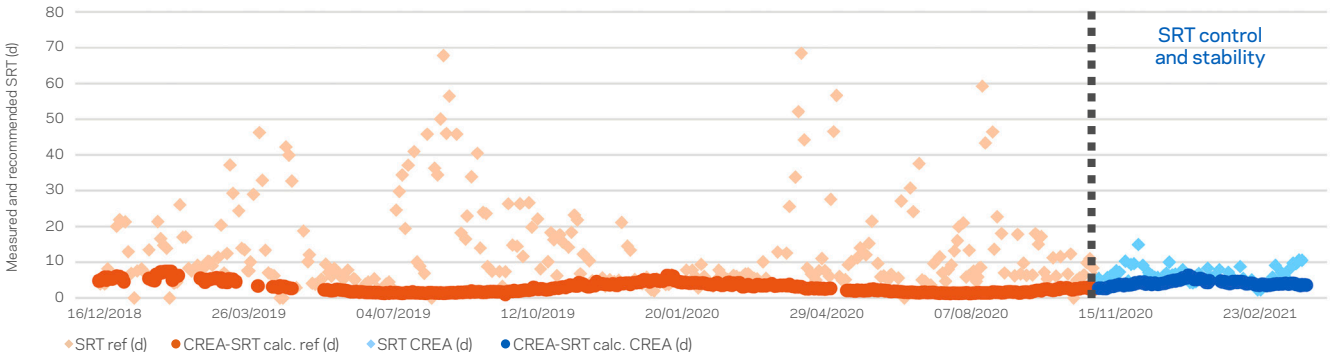
PROCESS STABILITY

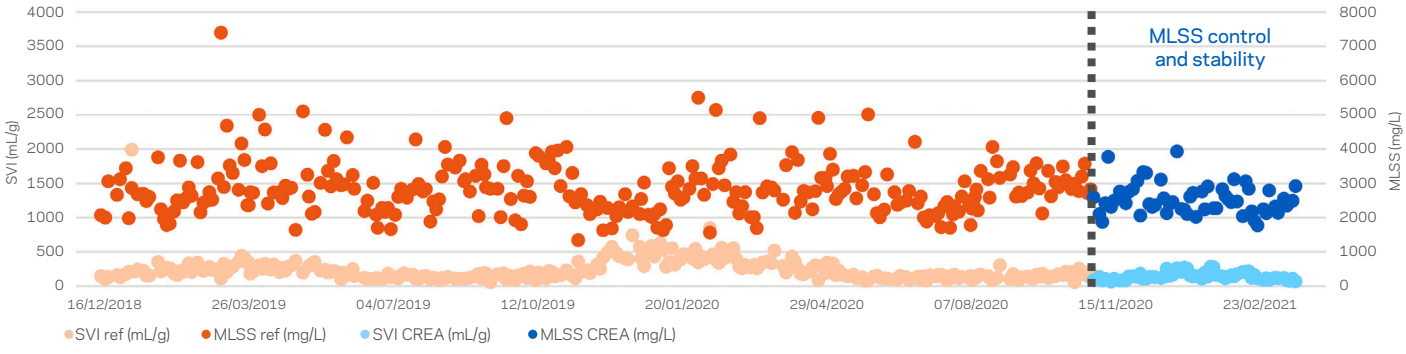
Nitrogen effluent quality



Sludge residence time (SRT)



MLSS and SVI



All data provided by the client; Aigües de Manresa

CLIENT CONCLUSIONS

Antoni Ventura
GENERAL MANAGER
Aigües de Manresa

AIGÜES MANRESA
GESTIÓ PÚBLICA DE L'AIGUA

"The aim of the implementation of the control platform was to overcome the existing limitations with the nitrogen removal and non-compliance events. The results of the platform have gone over and beyond our expectations, allowing us to meet nitrogen discharge limits without the need to make any significant investment in the plant. The combination of aeration and biomass control was also demonstrated, as it improved the overall performance of the biological treatment operation enabling to work under stable and optimal biomass and sludge age conditions. All in all, this not only resulted in increased treatment capacity and energy efficiency, but also in optimal process stability and sludge quality."