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OPINION ON GAUGING AND ANALYSIS. PILZAN WELL WATER. (HUESCA)

Background and objectives

On 21 February last, Mr César Alberini contacted TUBKAL INGENIERÍA for information on how to market water from a well located on a 12-ha property in Pilzán (Huesca).

According to the information provided by the client, the well is 120-m deep and collects water from cut limestone at a depth of 100 m. The flow rate of the well, after gauging for 2 hours, was 17 m_3/h. A partial chemical analysis is also available and indicates that it is a calcium bicarbonate water.

The objective of the work is limited to obtaining the administrative licence to use the well water. FIOREMAR will be responsible for the industrial project and business plan for the economic activity, with all the permits this entails (mainly local authorities, Industry, Environment and Health). When the time comes, TUBKAL can facilitate contact with specialised engineering consultancies for the industrial part of the work.

Well gauging and improvements in the curb area

On 2 and 3 October 2018, a temporary pumping facility was set up so that the well could be sampled once the representativeness of the sample had been ensured.

Before installing the pump, the well borehole was adapted. A DN225 steel reel with a flanged closure was welded onto the original pipe, which was protruding from the ground and did not have sufficient protection or health guarantees. A closed counter-flange was fitted to the flange to prevent foreign bodies from entering the well.

A pump capable of lifting 2 l/s from a depth of 100 metres was installed for the sampling process. The pump suction point was placed at a depth of 102 m. The static water level was 52.34 m before pumping started.

The sampling process was carried out over almost 24 hours. During this time the water changed from orange in colour, with numerous suspended solids (see photographic report) to crystal clear at the end of pumping, which is when the sample was taken.

Two flow stages were completed: the first at 0.8 l/s, in which after 16 hours of pumping the level was more or less stabilised at almost 58 m; and a second stage at 1.6 l/s, with a downward trend in levels at the end of the pumping process at 63 m. See figure 1.

Although stabilisation was not reached, this flow rate would appear to be sustainable in a continuous operation of the well. Previous estimates of an operating flow of about 4-5 l/s are considered optimistic.

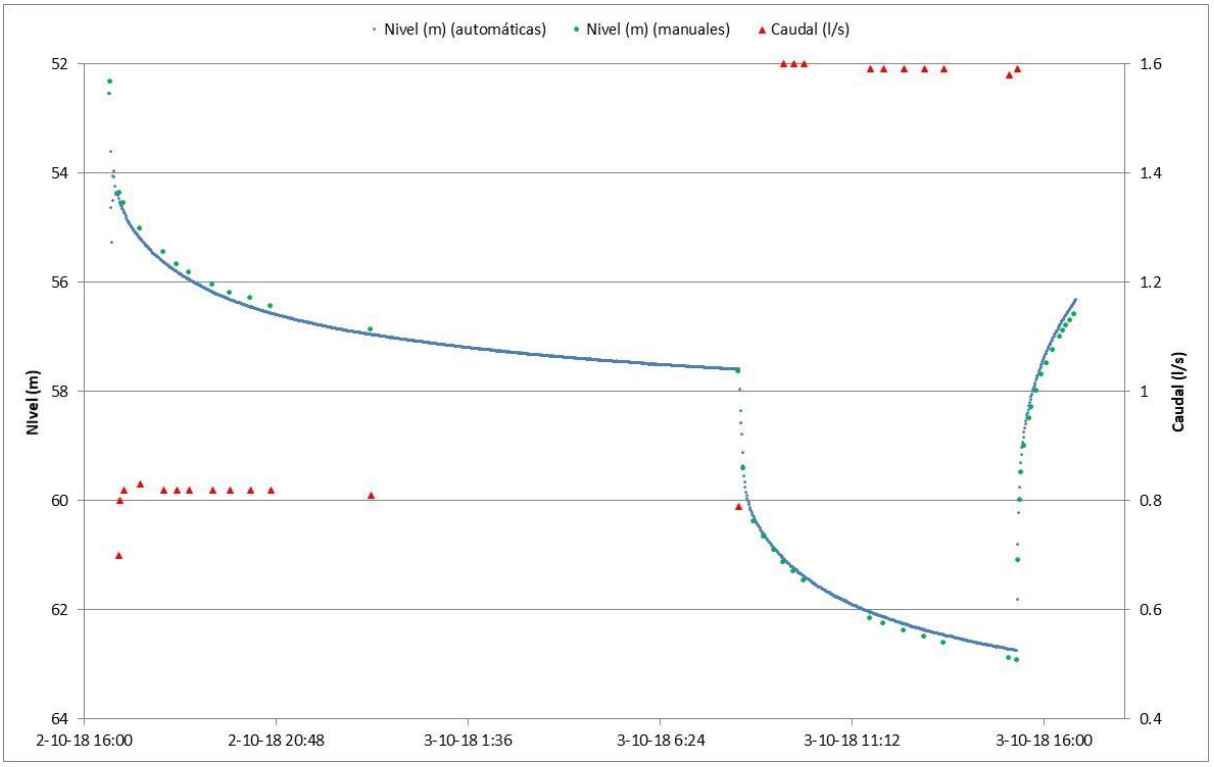

Figure 1. Graphical representation of the evolution of levels during pumping.

From the level recovery data it has been estimated that the transmissivity of the aquifer is between 5 and 10 m_2/d.

Once the sampling process had been completed and the well dismantled, a manhole made of prefabricated concrete with a metal cover, measuring 80x80 cm, was fitted to protect the well. As an additional protective measure, a 20-cm thick concrete slab was also laid, extending 1 m in each direction from the manhole. See photographic report.

Water analysis (RD 140/2003[1])

In view of the idea of selling water for human consumption[2] in cisterns, an analysis has been carried out in accordance with RD 140/2003 (potability). The analysis is to assess/demonstrate:

- That the water complies with the parametric values specified for drinking use.
- The need for treatment.

The water sample was taken a few minutes before the end of pumping, and the analyses were performed in the laboratory of Dr Oliver Rodés in Barcelona.

The analytical results—attached as annexes—show that the water from the Pilzán well is SUITABLE FOR CONSUMPTION, with the exception of the parameter for IRON, which exceeds the parametric values given in part C of Annex I of Royal Decree 140/2003. This can be corrected with little treatment.

Albeit beyond the scope of this study, and for information purposes only, a comparison of the results with the criteria established for natural mineral waters (RD 1798/2010) shows that all the parameters are met except for iron (which could be eliminated). However, the content of acrylamide and vinyl chloride, together with oxidisability and pseudomonas, is yet to be determined; however, they are unlikely to be present in the Pilzan well water in unauthorised concentrations.

Proposed next steps

1 - Determine whether to continue with the sale of the water.

TUBKAL will establish a hypothetical consumption scenario for legalisation purposes, depending on the specifications of the well and FIOREMAR's business plan. Work included in the agreed budget.

2 - Option for declaration of the status of 'Natural Mineral'.

The chemical characteristics of the water make this an option and the commercial outlet may be easier; however, TUBKAL recommends this option only if support from an investor is available. In any case, the project would need to be refocused.

[1] Royal Decree 140/2003 of 7 February, establishing health criteria for the quality of water for human consumption.

[2] Water for human consumption is all water—in its original state or after treatment—used for domestic purposes, drinking water and the food industry, etc. and supplied to the consumer through public or private distribution networks, cisterns or public or private tanks.

Photographic report.

Inside of the well

Borehole with flange

Curb of the well with closed counter-flange

Pumping equipment

Insertion of pump in well

Installation of automatic sensors

Pumping pipe

Installation supported on joists

Start-up water

Details of start-up water

Water after 1 hour of pumping

Water at the end of pumping

Crystal clear water

Pumping installation

Formwork for floor slab

Building work to protect well

Finished manhole

Borehole inside manhole

TUBKAL INGENIERIA, S.L.
Zaragoza, 11 December 2018

Oliver Rodés

Reg. No.:

ANALYSIS REPORT

Client	TUBKAL INGENIERÍA, S.L. c/ Joan Gamper, 25, baixos 08014 BARCELONA
Analysis	Radioactivity analysis of a water sample
Specifications	Royal Decree 140/2003 of 7 February establishing health criteria for the quality of water for human consumption. Consolidated text (1 August 2018). "Programme for Health Surveillance and Control of Water for Human Consumption in Catalonia" - Generalitat de Catalunya - Regional Department of Health - Directorate General for Public Health (December 2005)

Sample Information

Sample Type Water for human consumption

Reference Indicated **Pilzán**

Description of the sample-taking process Sample taken by applicants.

Packaging of applicants.

Packaging Type Polymeric material.

Dates

Date of receipt	Start date	End date
05/10/2018	05/10/2018	09/11/2018

Technical Director
Marta Pedemonte Almirall
Approval
12/11/2018

Chemical Supervisor
Núria Pàmies Fabregat
Approval 12/11/2018

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Oliver Rodés

Reg. No.:

RESULTS OBTAINED

Grouped according to RD 140/2003

ANNEX X - RADIOACTIVE PARAMETERS

Parameter	Notes	Result	Parametric Value	Units
Total alpha activity LC IT S1T001, S1T029		0.028 (±0.019)	——	Bq/L
Remaining beta activity LC IT S1T044, S1T029		<0.028	——	Bq/L
Total beta activity LC IT S1T001, S1T029		0.060 (±0.022)	——	Bq/L
Indicative Dose (ID) LC IT Calculation		<=0.10	0.10	mSv
Radon LC IT S1T034	1	12.5 (±2.1)	500	Bq/L
Tritium LC IT S1T006, S1T028	2	<4.2	100	Bq/L

NOTES

Specific notes

§	Parametric value specific to the regional surveillance programme.
--	The applied specifications (see report cover page) do not indicate a parametric value for this parameter. When no specification is given, this symbol appears in all parameters.
LC	Determination carried out by a collaborating laboratory.
1	Wherever possible and without prejudice to the water supply, actions by managers will aim to optimise the protection of the population when radon levels are below 500 Bq/l and above 100 Bq/l. Corrective measures are considered justified on radiological protection grounds, without further consideration, when radon concentrations exceed 1000 Bq/l. (RD 140/2003 Consolidated text)
2	High tritium levels may indicate the presence of other artificial radionuclides. If the tritium concentration is higher than its parametric value, an analysis of the presence of other artificial radionuclides is required. (RD 140/2003 Consolidated text)

General notes

Numerical values accompanied by the sign "<" indicate that the result obtained does not exceed the lower quantification limit of the corresponding analytical method.

Numerical values accompanied by the sign ">" indicate that the result obtained exceeds the upper quantification limit of the corresponding analytical method.

This results report is exclusively for the sample analysed.

El Prat de Llobregat (Barcelona), 12 November 2018

Oliver Rodés

Reg. No.:

ANALYSIS REPORT

Client	TUBKAL INGENIERÍA, S.L. c/ Joan Gamper, 25, baixos 08014 BARCELONA
Analysis	COMPLETE ANALYSIS. Parameters listed in parts A, B1 and C of Annex I to Royal Decree 140/2003.
Specifications	Royal Decree 140/2003 of 7 February establishing health criteria for the quality of water for human consumption. Consolidated text (1 August 2018). "Programme for Health Surveillance and Control of Water for Human Consumption in Catalonia" - Generalitat de Catalunya - Regional Department of Health - Directorate General for Public Health (December 2005)

Sample Information

Sample Type Water for human consumption

Reference Indicated **Pilzán**

Description of the sample-taking process * Sample taken by applicants.

Packaging of applicants.

Packaging Type Polymeric material.

Dates

Date of receipt	Start date	End date
05/10/2018	05/10/2018	07/11/2018

Technical Director
Marta Pedemonte Almirall
Approval
08/11/2018

Microbiology Supervisor
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Approval
08/11/2018

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ENAC ENSAYOS Nº 251/LE510

* Test not included in the scope of accreditation or result outside the accredited range.

Oliver Rodés

Reg. No.:

RESULTS OBTAINED

Grouped according to RD 140/2003

ANNEX I - PART A: MICROBIOLOGICAL PARAMETERS

Parameter	Notes	Result (Uncertainty)	Parametric Value	Units
Escherichia coli ISO 9308-1:2014. Count by filtration		0	0	cfu/100 mL
Enterococci PI PAMB-15. Count by filtration		0	0	cfu/100 mL
Clostridium perfringens PI PAMB-20. Count by filtration		0	0	cfu/100 mL

ANNEX I - PART C: INDICATOR PARAMETERS

Parameter	Notes	Result (Uncertainty)	Parametric Value	Units
Aerobes at 22ºC PI PAMB-36. Count.	1 2	6	——	cfu/mL
Coliform bacteria ISO 9308-1:2014. Count by filtration		0	0 [10]§	cfu/100 mL

ANNEX I - PART B.1: CHEMICAL PARAMETERS

Parameter	Notes	Result (Uncertainty)	Parametric Value	Units
Antimony PI PAFQ-97. ICP-MS		<2.0	5.0	µg Sb/L
Arsenic PI PAFQ-97. ICP-MS		<2.0	10	µg As/L
Benzene PI PAFQ-39. GC-MS.		<0.5	1.0	µg/L
* Benzo(a) pyrene PI PAFQ-99. GC-MS/MS		<0.010	0.010	µg/L
Boron PI PAFQ-97. ICP-MS		<0.025	1.0	mg B/L
Bromate PI PAFQ-08. Ion chromatography.		<2	10	µg BrO_3/L
Cadmium PI PAFQ-97. ICP-MS		<1.0	5.0	µg Cd/L
* Cyanide PI PAFQ-42. UV-Vis spectrophotometry.		<10	50	µg CN/L
Copper PI PAFQ-97. ICP-MS		<0.010	2.0	mg Cu/L
Chrome PI PAFQ-97. ICP-MS		<5.0	50	µg Cr/L
1,2-dichloroethane; PI PAFQ-39. GC-MS.		<0.5	3.0	µg/L
Fluoride PI PAFQ-51. Ion chromatography.		<0.20	1.5	mg F/L
Aromatic polycyclic hydrocarbons				
* Benzo (b) fluoranthene PI PAFQ-99. GC-MS/MS		<0.01	——	µg/L
* Benzo (k) fluoranthene PI PAFQ-99. GC-MS/MS		<0.02	——	µg/L
* Benzo (g,h,i) perylene PI PAFQ-99. GC-MS/MS		<0.02	——	µg/L
* Indeno (1,2,3,cd) pyrene PI PAFQ-99. GC-MS/MS		<0.02	——	µg/L
* Total aromatic polycyclic hydrocarbons (Benzo (b) fluoranthene + Benzo (k) fluoranthene + Benzo (g,h,i) perylene + Indeno (1,2,3,cd) pyrene). PI PAFQ-99. Calculation.		<0.10	0.10	µg/L
Mercury PI PAFQ-85. Atomic fluorescence.		<0.20	1.0	µg Hg/L
Nickel PI PAFQ-97. ICP-MS		<10	20	µg Ni/L
Nitrate PI PAFQ-51. Ion chromatography.		34.5 (±15%)	50	mg NO_3/L
Nitrite PI PAFQ-17. UV-Vis spectrophotometry.	3	<0.02	0.5	mg NO_2/L

Parameter Notes	Result (Uncertainty)	Value Parametric	Units
Nitrate/50 + Nitrite/3 PI. Calculation.	0.7	1.0	mg/L
* Total pesticides: PI PAFQ-99. Calculation.	<0.50	0.50	µg/L
Organochlorine pesticides			
* Aldrin PI PAFQ-99. GC-MS/MS	<0.01	0.03	µg/L
* alpha - HCH PI PAFQ-99. GC-MS/MS	<0.01	0.10	µg/L
* beta - HCH PI PAFQ-99. GC-MS/MS	<0.01	0.10	µg/L
* gamma - HCH (Lindane) PI PAFQ-99. GC-MS/MS	<0.01	0.10	µg/L
* delta - HCH PI PAFQ-99. GC-MS/MS	<0.01	0.10	µg/L
* 4.4' - DDD PI PAFQ-99. GC-MS/MS	<0.01	0.10	µg/L
* 4.4' - DDE PI PAFQ-99. GC-MS/MS	<0.01	0.10	µg/L
* 4.4' - DDT PI PAFQ-99. GC-MS/MS	<0.01	0.10	µg/L
* Dieldrin PI PAFQ-99. GC-MS/MS	<0.01	0.03	µg/L
* Endosulfan I PI PAFQ-99. GC-MS/MS	<0.01	0.10	µg/L
* Endosulfan II PI PAFQ-99. GC-MS/MS	<0.01	0.10	µg/L
* Endosulfan sulphate PI PAFQ-99. GC-MS/MS	<0.01	0.10	µg/L
* Endrin PI PAFQ-99. GC-MS/MS	<0.01	0.10	µg/L
* Heptachlor PI PAFQ-99. GC-MS/MS	<0.01	0.03	µg/L
* Heptachlor epoxide PI PAFQ-99. GC-MS/MS	<0.01	0.03	µg/L
* Methoxychlor PI PAFQ-99. GC-MS/MS	<0.01	0.10	µg/L
* Chlorobenzilate PI PAFQ-99. GC-MS/MS	<0.01	0.10	µg/L
* Chlorpyrifos PI PAFQ-99. GC-MS/MS	<0.01	0.10	µg/L
* DCPA PI PAFQ-99. GC-MS/MS	<0.01	0.10	µg/L
* Hexachlorobenzene PI PAFQ-99. GC-MS/MS	<0.01	0.10	µg/L
* cis-Permethrin PI PAFQ-99. GC-MS/MS	<0.01	0.10	µg/L
* trans - Permethrin PI PAFQ-99. GC-MS/MS	<0.01	0.10	µg/L
* Trifluralin PI PAFQ-99. GC-MS/MS	<0.01	0.10	µg/L
Organophosphorus pesticides:			
* Diazinon PI PAFQ-99. GC-MS/MS	<0.05	0.10	µg/L
* Disulfoton PI PAFQ-99. GC-MS/MS	<0.05	0.10	µg/L
* Ethoprop PI PAFQ-99. GC-MS/MS	<0.05	0.10	µg/L
* Fenthion PI PAFQ-99. GC-MS/MS	<0.05	0.10	µg/L
* Methyl parathion PI PAFQ-99. GC-MS/MS	<0.05	0.10	µg/L
* Phorate PI PAFQ-99. GC-MS/MS	<0.05	0.10	µg/L
* Ronnel (Fenchlorfos) PI PAFQ-99. GC-MS/MS	<0.05	0.10	µg/L
* Tokuthion PI PAFQ-99. GC-MS/MS	<0.05	0.10	µg/L
* Trichloronate PI PAFQ-99. GC-MS/MS	<0.05	0.10	µg/L
Triazines (herbicides):			
* Atrazine PI PAFQ-99. GC-MS/MS	<0.01	0.10	µg/L
* Atrazine-desethyl PI PAFQ-99. GC-MS/MS	<0.05	0.10	µg/L
* Prometryn PI PAFQ-99. GC-MS/MS	<0.01	0.10	µg/L

Parameter	Notes	Result (Uncertainty)	Value Parametric	Units
* Propazine PI PAFQ-99. GC-MS/MS		<0.01	0.10	µg/L
* Simazine PI PAFQ-99. GC-MS/MS		<0.03	0.10	µg/L
* Terbuthylazine PI PAFQ-99. GC-MS/MS		<0.01	0.10	µg/L
* Terbutryn PI PAFQ-99. GC-MS/MS		<0.01	0.10	µg/L
Lead PI PAFQ-97. ICP-MS		<5.0	10	µg Pb/L
Selenium PI PAFQ-97. ICP-MS		<5	10	µg Se/L
Trihalomethanes				
Chloroform (Trichloromethane) PI PAFQ-39. GC-MS.		<5	——	µg/L
Bromoform (Tribromomethane) PI PAFQ-39. GC-MS.		<1	——	µg/L
Dibromochloromethane PI PAFQ-39. GC-MS.		<1	——	µg/L
Bromodichloromethane PI PAFQ-39. GC-MS.		<1	——	µg/L
Total Trihalomethanes PI PAFQ-39. Calculation.		<8	100	µg/L
Tetrachloroethene PI PAFQ-39. GC-MS.		<1	——	µg/L
Trichloroethene PI PAFQ-39. GC-MS.		<1	——	µg/L
Tetrachloroethene + Trichloroethene PI PAFQ-39. Calculation.		<2	10	µg/L

ANNEX I - PART C: PARAMETERS INDICATORS

Parameter	Notes	Result (Uncertainty)	Parametric Value	Units
Aluminium PI PAFQ-97. ICP-MS		<10	200	µg Al/L
Ammonium PI PAFQ-19. UV-Vis spectrophotometry.		<0.10	0.50 [0.50]§	mg NH_4/L
Total residual chlorine Determination: In the Laboratory PI PAFQ-40. Colorimetry.	4	<0.10	——	mg Cl_2/L
Combined residual chlorine Determination: In the Laboratory PI PAFQ-40. Colorimetry.	5 4	<0.10	2.0	mg Cl_2/L
Free residual chlorine Determination: In the Laboratory PI PAFQ-40. Colorimetry.	5 4	<0.10	1.0	mg Cl_2/L
Chloride PI PAFQ-51. Ion chromatography.		7.1 (±15%)	250	mg Cl/L
* Colour PI PAFQ-16. Colorimetry		<5	15	mg/L Pt/Co
Conductivity at 20°C PI PAFQ-04. Electrometry.		500 (±10%)	2500	µS/cm
Iron PI PAFQ-97. ICP-MS		218 (±20%)	200	µg Fe/L
Manganese PI PAFQ-97. ICP-MS		<5.0	50 [400]§	µg Mn/L
* Smell Determination: In the Laboratory - Type of smell: No smell anomalous PI PAFQ-31. Organoleptic.	6	1	3	Dilution rate
Oxidisability ($KMnO_4$) PI PAFQ-24. Volumetry.		<0.5	5.0 [5.0]§	mg O_2/L
pH Temperature: 23°C PI PAFQ-03. Electrometry.	7	7.35 (±0.17)	6.5-9.5	
* Taste Determination: In the Laboratory - Taste type: Not determined PI PAFQ-31. Organoleptic.	6 8	--	3	Dilution rate
Sodium PI PAFQ-65. Atomic emission.		2.4 (±30%)	200	mg Na/L
Sulphate PI PAFQ-51. Ion chromatography.		14.6 (±10%)	250	mg SO_4/L
Turbidity PI PAFQ-15. Nephelometry.	9	1.4 (±20%)	5 [5.0]§	UNF

Oliver Rodés

Reg. No.:

Parameter	Notes	Result (Uncertainty)	Value Parametric	Units
Saturation index (Langelier) PI PAFQ-48. Calculation.	10	0.3	——	

OTHER DETERMINATIONS NO INCLUDED IN RD 140/2003

Parameter	Notes	Result (Uncertainty)	Parametric Value	Units
Carbonate PI PAFQ-46. Volumetry.		<1.2	——	mg CO_3/L
Alkalinity (T.A.) PI PAFQ-46. Volumetry.		<1.0	——	mg $CaCO_3$/L
BICARBONATE PI PAFQ-46. Volumetry.		287 (±7%)	——	mg HCO_3/L
Alkalinity (T.A.C.) PI PAFQ-46. Volumetry.		235 (±7%)	——	mg $CaCO_3$/L
Calcium PI PAFQ-50. Volumetry.		102 (±9%)	——	mg Ca/L
Total hardness PI PAFQ-09. Calculation.		28.7 (±6%)	——	°F
Total hardness PI PAFQ-09. Calculation.		287 (±6%)	——	mg $CaCO_3$/L
Magnesium PI PAFQ-50. Volumetry.		7.7 (±16%)	——	mg Mg/L

NOTES

Specific notes

§	Parametric value specific to the regional surveillance programme.
--	The applied specifications (see report cover page) do not indicate a parametric value for this parameter. When no specification is given, this symbol appears in all parameters.
PI	Internal Procedure.
1	In the distribution network: No anomalous changes with regard to the outlet of the treatment plant. At the outlet of the DWTP (treatment): The parametric value is 100 cfu in 1 mL. (RD 140/2003)
2	According to ISO 8199, counts between 1 and 3 cfu/volume analysed imply detection of the presence of the organism, and counts between 4 and 9 cfu/volume analysed are an estimate.
3	At the outlet of the DWTP and/or tank: The parametric value is 0.1 mg NO_2/L. In the distribution network: The parametric value is 0.5 mg NO_2/L. (RD 140/2003)
4	The results may be influenced by the time elapsed between sample collection and determination. Parametric values
5	refer to the level in the distribution network. For the food industry, this parameter will not be considered in process water. (RD 140/2003)
6	If the determination of smell and/or taste is appreciable, it will be carried out at 25°C and the dilution index will be calculated until smell and/or taste have disappeared.
7	For the food industry, the minimum value may be reduced to 4.5 pH units. (RD 140/2003)
8	The organoleptic determination of taste will only be carried out on chlorinated water or water of known bacteriological potability.
9	At the outlet of the DWTP and/or tank: The parametric value is 1 UNF. In the distribution network: The parametric value is 5 UNF. (RD 140/2003)
10	The water must not be an aggressive or encrusting substance at any time. The result of calculating the Langelier Index should be ± 0.5. (RD 140/2003)

General notes

Numerical values accompanied by the sign "<" indicate that the result obtained does not exceed the lower quantification limit of the corresponding analytical method.

Numerical values accompanied by the sign ">" indicate that the result obtained exceeds the upper quantification limit of the corresponding analytical method.

The uncertainty of physicochemical analyses is indicated when the result is within the accredited working range. The uncertainty of microbiological analytical methods included in the scope of accreditation is at clients' disposal.

This results report is exclusively for the sample analysed.

El Prat de Llobregat (Barcelona), 8 November 2018