

## Evaluation of the influence of plastic pipes on water intended for human consumption due to migration

Customer:

**CERTIF – Associação para a Certificação**  
Rua José Afonso, 9E  
2810-237 Almada

## REPORT (QUI936/23)





## Report

### Evaluation of the influence of plastic pipes on water intended for human consumption due to migration

#### 1 - Scope of the report

The present report is the outcome of a request from CERTIF – Associação para a Certificação to perform migration tests on a sample of plastic tubes intended for transporting water for human consumption. Migration tests were performed for the organoleptic evaluation of the water and for the evaluation of the migration of substances into the water. The migration tests were performed using non-chlorinated test water at a temperature of 85°C and chlorinated and non-chlorinated test water at a temperature of 23°C. Physicochemical tests were performed on these migration waters, taking into account the fulfilment of the Portuguese “Decreto-Lei nº 69/2023, de 21 de agosto, and the requirements found in “Annex A” from the “Project of Regulation which lays down the conditions of the Approval Scheme in Portugal for products in contact with water intended for human consumption” of the ERSAR (The Water and Waste Services Regulation Authority). To this effect, on the 26<sup>th</sup> June 2023, the client delivered a sample of a polybutene pipes with the commercial name “TERRAIN SDP PB 15 x 1,7 mm”, registered by Itecons as QUI779A/23. Sampling was of the responsibility of the customer and is outside the scope of Accreditation. The results presented in this report refer only to the tested items and apply to the sample as received. All tests were performed in the Itecons laboratories.

#### 2 - Specifications of the test product

The sample delivered (Itecons reference QUI779A/23) corresponds to a product with homogeneous composition of industrial manufacture and with the specifications that are shown in Table 1.

**Table 1:** Specifications of the product with reference “TERRAIN SDP PB 15 x 1,7 mm” (Itecons reference QUI779A/23), corresponding to polybutene pipes (data supplied by the customer)

	Product Specifications
Manufacturer	NUEVA TERRAIN S.L.
Manufacturing site	c/ PADULETA, 2 - 01015 - VITORIA (SPAIN)
Commercial name	TERRAIN SDP PB 15 x 1,7 mm
Date of manufacture	14-06-2023
Colour	GREY
Lot number	BE0124BJ5
Product code	TFC.058.015
Base raw material	POLYBUTENE-1
Raw material manufacturer	LYONDELLBASELL
Raw material brand	AKOALIT PB 4267 GREY
Other constituents	---
Date of sampling	---
Type of sampling	PIPE
Sampling performed by	OSCAR CALVO
Number of test pieces delivered	370
External diameter (mm)	15
Length (mm)	90
Thickness (mm)	1.7
Type of use	Transporting warm water for human consumption (T= 85 °C)

### 3 - Migration tests performed using non-chlorinated water at 85°C

Migration tests for the organoleptic evaluation of the water and for the evaluation of the migration of substances into the water, at a temperature of 85°C, were performed using non-chlorinated water under the conditions described in sections 3.1 and 3.2, respectively. The results obtained are also presented.

### 3.1 - Migration tests for the organoleptic evaluation of water (performed using non-chlorinated water at 85°C)

The migration tests for the organoleptic evaluation of water were performed using non-chlorinated water at 85°C under the conditions and on the dates shown in Tables 2 and 3. The results obtained for the migration water and the blank water for the three migration periods are presented in Tables 4, 5 and 6. The analytical methods applied to the migration waters are presented in Annex A (Table A1).

**Table 2:** Conditions of the migration tests for the organoleptic evaluation, using non-chlorinated water at 85°C, for the sample with reference "TERRAIN SDP PB 15 x 1,7 mm" (Itecons reference QUI779A/23), corresponding to polybutene pipes

Conditions of the migration tests	
Test method	QUI.12.IE.01, Version: 2 (Feb/18) equivalent to EN 1420:2016 <sup>(nac)</sup> QUI.13.IE.01, Version: 3 (Aug/2021) equivalent to EN 13052-1:2001
Number of test pieces tested	26
Total superficial area – S (dm <sup>2</sup> )	19.92
Test water used	Ultrapure water
Volume of the test water – V (l)	0.8
Ratio S/V (dm <sup>-1</sup> )	24.90
Migration temperature – T (° C)	85 ± 2
Duration of each migration period (h)	24 ± 1
Number of migration periods	3
Test start date	14-09-2023
Test completion date	22-09-2023

Tests marked with <sup>(nac)</sup> are not included in the scope of accreditation.

"QUI.xx.IE.xx" corresponds to the internal method of Itecons. The equivalent internal method shall be that which meets the performance characteristics and obtains results that are comparable to the standard method(s) listed therein.

**Table 3:** Dates of the migration tests for the organoleptic evaluation, using non-chlorinated water at 85°C, for the sample with reference "TERRAIN SDP PB 15 x 1,7 mm" (Itecons reference QUI779A/23), corresponding to polybutene pipes

	Migration test		Physicochemical tests	
	Start	End	Start	End
Pre-treatment	14-09-2023	19-09-2023	---	---
1 <sup>a</sup> Migration	19-09-2023	20-09-2023	21-09-2023	25-09-2023
2 <sup>a</sup> Migration	20-09-2023	21-09-2023	21-09-2023	25-09-2023
3 <sup>a</sup> Migration	21-09-2023	22-09-2023	22-09-2023	25-09-2023

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3/24

**Table 4:** Results obtained for the 1<sup>st</sup> migration for the organoleptic evaluation, using non-chlorinated water at 85°C, for the migration water and for the blank water

Parameter (Unit)	$a_1^T$	$b_1^T$	$c_1^T$
Odour, at 23°C <sup>(nac)</sup> (Dilution Factor)	<1	<1	<1
Flavour, at 23°C <sup>(nac)</sup> (Dilution Factor)	<1	<1	<1
Colour (mg PtCo/l)	<5	<5	<5
Turbidity (NTU)	<0.50	<0.50	<0.50

T – Migration temperature.

$a_1^T$  – Concentration of the measured substance in the water of the 1<sup>st</sup> migration.

$b_1^T$  – Concentration of the measured substance in the blank water of the 1<sup>st</sup> migration.

$c_1^T$  – Concentration of the measured substance ( $a_1^T - b_1^T$ ) in the 1<sup>st</sup> migration.

< x – The results expressed in this form, indicate that the result is inferior to the [Quantification Limit (x) - Uncertainty], except for the odour and flavour parameters, in which the formulation < x means that there is an absence of perception for a dilution factor of x.

≤ x – The results expressed in this form, indicate that the result falls within the range defined by [Quantification Limit (x) ± Uncertainty].

The tests marked with <sup>(nac)</sup> are not included in the scope of accreditation.

**Table 5:** Results obtained for the 2<sup>nd</sup> migration for the organoleptic evaluation, using non-chlorinated water at 85°C, for the migration water and for the blank water

Parameter (Unit)	$a_2^T$	$b_2^T$	$c_2^T$
Odour, at 23°C <sup>(nac)</sup> (Dilution Factor)	<1	<1	<1
Flavour, at 23°C <sup>(nac)</sup> (Dilution Factor)	<1	<1	<1
Colour (mg PtCo/l)	<5	<5	<5
Turbidity (NTU)	<0.50	<0.50	<0.50

T – Migration temperature.

$a_2^T$  – Concentration of the measured substance in the water of the 2<sup>nd</sup> migration.

$b_2^T$  – Concentration of the measured substance in the blank water of the 2<sup>nd</sup> migration.

$c_2^T$  – Concentration of the measured substance ( $a_2^T - b_2^T$ ) in the 2<sup>nd</sup> migration.

< x – The results expressed in this form, indicate that the result is inferior to the [Quantification Limit (x) - Uncertainty], except for the odour and flavour parameters, in which the formulation < x means that there is an absence of perception for a dilution factor of x.

≤ x – The results expressed in this form, indicate that the result falls within the range defined by [Quantification Limit (x) ± Uncertainty].

The tests marked with <sup>(nac)</sup> are not included in the scope of accreditation.

**Table 6:** Results obtained for the 3<sup>rd</sup> migration for the organoleptic evaluation, using non-chlorinated water at 85°C, for the migration water and for the blank water

Parameter (Unit)	$a_3^T$	$b_3^T$	$c_3^T$
Odour, at 23°C <sup>(nac)</sup> (Dilution Factor)	<1	<1	<1
Flavour, at 23°C <sup>(nac)</sup> (Dilution Factor)	<1	<1	<1
Colour (mg PtCo/l)	<5	<5	<5
Turbidity (NTU)	<0.50	<0.50	<0.50

T – Migration temperature.

$a_3^T$  – Concentration of the measured substance in the water of the 3<sup>rd</sup> migration.

$b_3^T$  – Concentration of the measured substance in the blank water of the 3<sup>rd</sup> migration.

$c_3^T$  – Concentration of the measured substance ( $a_3^T - b_3^T$ ) in the 3<sup>rd</sup> migration.

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$< x$  – The results expressed in this form, indicate that the result is inferior to the [Quantification Limit ( $x$ ) - Uncertainty], except for the odour and flavour parameters, in which the formulation  $< x$  means that there is an absence of perception for a dilution factor of  $x$ .

$\leq x$  – The results expressed in this form, indicate that the result falls within the range defined by [Quantification Limit ( $x$ )  $\pm$  Uncertainty].

The tests marked with <sup>(nac)</sup> are not included in the scope of accreditation.

### 3.2 - Migration tests for the evaluation of the migration of substances into the water (performed using non-chlorinated water at 85°C)

The migration tests for the evaluation of the migration of substances into the water were performed using non-chlorinated water, at a temperature of 85°C, under the conditions and on the dates shown in Tables 7 and 8. The results obtained for the migration water and the blank for the three migration periods are presented in Tables 9, 10 and 11. The analytical methods applied to the migration waters are presented in Annex A (Table A1).

**Table 7:** Conditions of the migration tests for the evaluation of the migration of substances, using non-chlorinated water at 85°C, for the sample with reference “TERRAIN SDP PB 15 x 1,7 mm” (Itecons reference QUI779A/23), corresponding to polybutene pipes

	Conditions of the migration tests
Test method	QUI.11.IE.01, Version: 5 (May/2020) equivalent to EN 12873-1:2014
Number of samples/specimens tested	98
Total superficial area – S (dm <sup>2</sup> )	75.10
Test water used	Ultrapure water
Volume of the test water – V (l)	2.8
Ratio S/V (dm <sup>-1</sup> )	26.82
Migration temperature – T (°C)	85 $\pm$ 2
Duration of each migration period (h)	24 $\pm$ 1
Number of migration periods	3
Test start date	18-09-2023
Test completion date	22-09-2023

"QUI.xx.IE.xx" corresponds to the internal method of Itecons. The equivalent internal method shall be that which meets the performance characteristics and obtains results that are comparable to the standard method(s) listed therein.

**Table 8:** Dates of the migration tests for the evaluation of the migration of substances, using non-chlorinated water at 85°C, for the sample with reference “TERRAIN SDP PB 15 x 1,7 mm” (Itecons reference QUI779A/23), corresponding to polybutene pipes

	Migration test		Physicochemical tests	
	Start	End	Start	End
Pre-treatment	18-09-2023	19-09-2023	---	---
1 <sup>a</sup> Migration	19-09-2023	20-09-2023	20-09-2023	25-10-2023
2 <sup>a</sup> Migration	20-09-2023	21-09-2023	21-09-2023	25-10-2023
3 <sup>a</sup> Migration	21-09-2023	22-09-2023	22-09-2023	25-10-2023

**Table 9:** Results obtained for the 1<sup>st</sup> migration for the evaluation of the migration of substances, using non-chlorinated water at 85°C, for the migration water and for the blank water

Parameter (Unit)	a <sub>1</sub> <sup>T</sup>	b <sub>1</sub> <sup>T</sup>	c <sub>1</sub> <sup>T</sup>	M <sub>1</sub> <sup>T</sup> (mg dm <sup>-2</sup> d <sup>-1</sup> )	C <sub>tap1</sub> <sup>T</sup> (mg/l)
pH (measuring temperature)	7.3 (21°C)	7.1 (21°C)	7.3 (21°C)	---	---
Conductivity, at 20°C (µS/cm)	<9.0	<9.0	<9.0	---	---
Free chlorine <sup>(1)</sup> (mg Cl <sub>2</sub> /l)	<0.10	<0.10	<0.10	<0.0037	<0.074
Cyanides (mg CN/l)	<0.005	<0.005	<0.005	<0.0002	<0.004
Bromates <sup>(nac)</sup> (mg BrO <sub>3</sub> /l)	<0.0013	<0.0013	<0.0013	<0.000048	<0.00096
Fluorides <sup>(nac)</sup> (mg F/l)	<0.20	<0.20	<0.20	<0.0075	<0.15
Nitrates <sup>(nac)</sup> (mg NO <sub>3</sub> /l)	<1.0	<1.0	<1.0	<0.037	<0.74
Chlorides <sup>(nac)</sup> (mg Cl/l)	<2.0	<2.0	<2.0	<0.075	<1.5
Sulphates <sup>(nac)</sup> (mg SO <sub>4</sub> /l)	<2.0	<2.0	<2.0	<0.075	<1.5
Ammonium <sup>(nac)</sup> (mg NH <sub>4</sub> /l)	<0.08	<0.08	<0.08	<0.003	<0.06
Calcium (mg Ca/l)	<0.10	<0.10	<0.10	<0.0037	<0.074
Magnesium (mg Mg/l)	<0.10	<0.10	<0.10	<0.0037	<0.074
Sodium (mg Na/l)	<0.30	<0.30	<0.30	<0.011	<0.22
Antimony (mg Sb/l)	<0.00050	<0.00050	<0.00050	<0.000019	<0.00038
Arsenic (mg As/l)	<0.0010	<0.0010	<0.0010	<0.000037	<0.00074
Boron (mg B/l)	<0.020	<0.020	<0.020	<0.00075	<0.015
Cadmium (mg Cd/l)	<0.00050	<0.00050	<0.00050	<0.000019	<0.00038
Chromium (mg Cr/l)	<0.0010	<0.0010	<0.0010	<0.000037	<0.00074
Copper (mg Cu/l)	<0.020	<0.020	<0.020	<0.00075	<0.015
Lead (mg Pb/l)	<0.0010	<0.0010	<0.0010	<0.000037	<0.00074
Mercury (mg Hg/l)	<0.00010	<0.00010	<0.00010	<0.0000037	<0.000074
Nickel (mg Ni/l)	<0.0010	<0.0010	<0.0010	<0.000037	<0.00074
Selenium (mg Se/l)	<0.0010	<0.0010	<0.0010	<0.000037	<0.00074
Aluminium (mg Al/l)	<0.010	<0.010	<0.010	<0.00037	<0.0074
Iron (mg Fe/l)	<0.010	<0.010	<0.010	<0.00037	<0.0074

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6/24



Parameter (Unit)	$a_1^T$	$b_1^T$	$c_1^T$	$M_1^T$ (mg dm <sup>-2</sup> d <sup>-1</sup> )	$Ctap_1^T$ (mg/l)
Manganese <sup>(nac)</sup> (mg Mn/l)	<0.005	<0.005	<0.005	<0.0002	<0.004
Total organic carbon (mg C/l)	<2.5	<2.5	<2.5	<0.093	<1.9
Acrylamide <sup>(nac)</sup> (mg/l)	<0.00013	<0.00013	<0.00013	<0.0000048	<0.000096
1,2-Dichloroethane (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000093	<0.00019
Vinyl chloride <sup>(nac)</sup> (mg/l)	<0.00013	<0.00013	<0.00013	<0.0000048	<0.000096
Epichlorohydrin <sup>(nac)</sup> (mg/l)	<0.00013	<0.00013	<0.00013	<0.0000048	<0.000096
Benzene (mg/l)	<0.00013	<0.00013	<0.00013	<0.0000048	<0.000096
Trichloroethylene (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000093	<0.00019
Tetrachloroethylene (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000093	<0.00019
Trihalomethanes:					
Chloroform (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000093	<0.00019
Bromodichloromethane (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000093	<0.00019
Dibromochloromethane (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000093	<0.00019
Bromoform (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000093	<0.00019
Polycyclic aromatic hydrocarbons:					
Benzo(a)pyrene (mg/l)	<0.000010	<0.000010	<0.000010	<0.00000037	<0.0000074
Benzo(b)fluoranthene (mg/l)	<0.000010	<0.000010	<0.000010	<0.00000037	<0.0000074
Benzo(g,h,i)perylene (mg/l)	<0.000010	<0.000010	<0.000010	<0.00000037	<0.0000074
Benzo(k)fluoranthene (mg/l)	<0.000010	<0.000010	<0.000010	<0.00000037	<0.0000074
Indene(1,2,3-cd)pyrene (mg/l)	<0.000010	<0.000010	<0.000010	<0.00000037	<0.0000074

T – Migration temperature.

$a_1^T$  – Concentration of the measured substance in the water of the 1<sup>st</sup> migration.

$b_1^T$  – Concentration of the measured substance in the blank water of the 1<sup>st</sup> migration.

$c_1^T$  – Concentration of the measured substance ( $a_1^T - b_1^T$ ) in the 1<sup>st</sup> migration.

$M_1^T$  – Migration rate expressed as a function of the concentration unit of the analysed parameter (mg) by area unit and by day of migration (dm<sup>-2</sup>d<sup>-1</sup>).

$Ctap_1^T$  – Concentration of the substance in the tap water (mg/l), representative of a real situation, obtained after the conversion of the migration rate in the 1<sup>st</sup> migration through the use of the conversion factor corresponding to the product under test (20 day.dm<sup>-1</sup>).

< x – The results expressed in this form, indicate that the result is inferior to the [Quantification Limit (x) - Uncertainty].

≤ x – The results expressed in this form, indicate that the result falls within the range defined by [Quantification Limit (x) ± Uncertainty].

The Tests marked with <sup>(nac)</sup> are not included in the scope of accreditation.

<sup>(1)</sup> For the purposes of interpreting the result of the determination of free chlorine, within the scope of the Portuguese “Decreto-Lei nº 69/2023, de 21 de agosto”, this corresponds to the residual disinfectant parameter, not included in the scope of accreditation.

**Table 10:** Results obtained for the 2<sup>nd</sup> migration for the evaluation of the migration of substances, using non-chlorinated water at 85°C, for the migration water and for the blank water

Parameter (Unit)	$a_2^T$	$b_2^T$	$c_2^T$	$M_2^T$ (mg dm <sup>-2</sup> d <sup>-1</sup> )	$Ctap_2^T$ (mg/l)
pH (measuring temperature)	7.1 (21°C)	6.9 (22°C)	7.1 (21°C)	---	---
Conductivity, at 20°C (µS/cm)	<9.0	<9.0	<9.0	---	---
Free chlorine <sup>(1)</sup> (mg Cl <sub>2</sub> /l)	<0.10	<0.10	<0.10	<0.0037	<0.074
Cyanides (mg CN/l)	<0.005	<0.005	<0.005	<0.0002	<0.004
Bromates <sup>(nac)</sup> (mg BrO <sub>3</sub> /l)	<0.0013	<0.0013	<0.0013	<0.000048	<0.00096
Fluorides <sup>(nac)</sup> (mg F/l)	<0.20	<0.20	<0.20	<0.0075	<0.15

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7/24

Parameter (Unit)	$a_2^T$	$b_2^T$	$c_2^T$	$M_2^T$ (mg dm <sup>-2</sup> d <sup>-1</sup> )	$C_{tap2}^T$ (mg/l)
Nitrates <sup>(nac)</sup> (mg NO <sub>3</sub> /l)	<1.0	<1.0	<1.0	<0.037	<0.74
Chlorides <sup>(nac)</sup> (mg Cl/l)	<2.0	<2.0	<2.0	<0.075	<1.5
Sulphates <sup>(nac)</sup> (mg SO <sub>4</sub> /l)	<2.0	<2.0	<2.0	<0.075	<1.5
Ammonium <sup>(nac)</sup> (mg NH <sub>4</sub> /l)	<0.08	<0.08	<0.08	<0.003	<0.06
Calcium (mg Ca/l)	<0.10	<0.10	<0.10	<0.0037	<0.074
Magnesium (mg Mg/l)	<0.10	<0.10	<0.10	<0.0037	<0.074
Sodium (mg Na/l)	<0.30	<0.30	<0.30	<0.011	<0.22
Antimony (mg Sb/l)	<0.00050	<0.00050	<0.00050	<0.000019	<0.00038
Arsenic (mg As/l)	<0.0010	<0.0010	<0.0010	<0.000037	<0.00074
Boron (mg B/l)	<0.020	<0.020	<0.020	<0.00075	<0.015
Cadmium (mg Cd/l)	<0.00050	<0.00050	<0.00050	<0.000019	<0.00038
Chromium (mg Cr/l)	<0.0010	<0.0010	<0.0010	<0.000037	<0.00074
Copper (mg Cu/l)	<0.020	<0.020	<0.020	<0.00075	<0.015
Lead (mg Pb/l)	<0.0010	<0.0010	<0.0010	<0.000037	<0.00074
Mercury (mg Hg/l)	<0.00010	<0.00010	<0.00010	<0.0000037	<0.000074
Nickel (mg Ni/l)	<0.0010	<0.0010	<0.0010	<0.000037	<0.00074
Selenium (mg Se/l)	<0.0010	<0.0010	<0.0010	<0.000037	<0.00074
Aluminium (mg Al/l)	<0.010	<0.010	<0.010	<0.00037	<0.0074
Iron (mg Fe/l)	<0.010	<0.010	<0.010	<0.00037	<0.0074
Manganese <sup>(nac)</sup> (mg Mn/l)	<0.005	<0.005	<0.005	<0.0002	<0.004
Total organic carbon (mg C/l)	<2.5	<2.5	<2.5	<0.093	<1.9
Acrylamide <sup>(nac)</sup> (mg/l)	<0.00013	<0.00013	<0.00013	<0.0000048	<0.000096
1,2-Dichlorethane (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000093	<0.00019
Vinyl chloride <sup>(nac)</sup> (mg/l)	<0.00013	<0.00013	<0.00013	<0.0000048	<0.000096
Epichlorohydrin <sup>(nac)</sup> (mg/l)	<0.00013	<0.00013	<0.00013	<0.0000048	<0.000096
Benzene (mg/l)	<0.00013	<0.00013	<0.00013	<0.0000048	<0.000096
Trichloroethylene (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000093	<0.00019
Tetrachloroethylene (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000093	<0.00019
Trihalomethanes:					
Chloroform (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000093	<0.00019
Bromodichloromethane (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000093	<0.00019
Dibromochloromethane (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000093	<0.00019
Bromoform (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000093	<0.00019
Polycyclic aromatic hydrocarbons:					
Benzo(a)pyrene (mg/l)	<0.000010	<0.000010	<0.000010	<0.00000037	<0.0000074
Benzo(b)fluoranthene (mg/l)	<0.000010	<0.000010	<0.000010	<0.00000037	<0.0000074
Benzo(g,h,i)perylene (mg/l)	<0.000010	<0.000010	<0.000010	<0.00000037	<0.0000074
Benzo(k)fluoranthene (mg/l)	<0.000010	<0.000010	<0.000010	<0.00000037	<0.0000074
Indene(1,2,3-cd)pyrene (mg/l)	<0.000010	<0.000010	<0.000010	<0.00000037	<0.0000074

T – Migration temperature.

$a_2^T$  – Concentration of the measured substance in the water of the 2<sup>nd</sup> migration.

$b_2^T$  – Concentration of the measured substance in the blank water of the 2<sup>nd</sup> migration.

$c_2^T$  – Concentration of the measured substance ( $a_2^T - b_2^T$ ) in the 2<sup>nd</sup> migration.

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8/24

$M_2^T$  – Migration rate expressed as a function of the concentration unit of the analysed parameter (mg) by area unit and by day of migration ( $\text{dm}^{-2}\text{d}^{-1}$ ).

$C_{\text{tap}_2}^T$  – Concentration of the substance in the tap water (mg/l), representative of a real situation, obtained after the conversion of the migration speed in the 2<sup>nd</sup> migration through the use of the conversion factor corresponding to the product under test (20 day. $\text{dm}^{-1}$ ).

< x – The results expressed in this form, indicate that the result is inferior to the [Quantification Limit (x) - Uncertainty].

≤ x – The results expressed in this form, indicate that the result falls within the range defined by [Quantification Limit (x) ± Uncertainty].

The Tests marked with <sup>(nac)</sup> are not included in the scope of accreditation.

<sup>(1)</sup> For the purposes of interpreting the result of the determination of free chlorine, within the scope of the Portuguese “Decreto-Lei nº 69/2023, de 21 de agosto”, this corresponds to the residual disinfectant parameter, not included in the scope of accreditation.

**Table 11:** Results obtained for the 3<sup>rd</sup> migration for the evaluation of the migration of substances, using non-chlorinated water at 85°C, for the migration water and for the blank water

Parameter (Unit)	$a_3^T$	$b_3^T$	$c_3^T$	$M_3^T$ (mg $\text{dm}^{-2}\text{d}^{-1}$ )	$C_{\text{tap}_3}^T$ (mg/l)
pH (measuring temperature)	7.1 (22°C)	7.2 (21°C)	7.1 (22°C)	---	---
Conductivity, at 20°C ( $\mu\text{S}/\text{cm}$ )	<9.0	<9.0	<9.0	---	---
Free chlorine <sup>(1)</sup> (mg $\text{Cl}_2/\text{l}$ )	<0.10	<0.10	<0.10	<0.0037	<0.074
Cyanides (mg $\text{CN}/\text{l}$ )	<0.005	<0.005	<0.005	<0.0002	<0.004
Bromates <sup>(nac)</sup> (mg $\text{BrO}_3/\text{l}$ )	<0.0013	<0.0013	<0.0013	<0.000048	<0.00096
Fluorides <sup>(nac)</sup> (mg $\text{F}/\text{l}$ )	<0.20	<0.20	<0.20	<0.0075	<0.15
Nitrates <sup>(nac)</sup> (mg $\text{NO}_3/\text{l}$ )	<1.0	<1.0	<1.0	<0.037	<0.74
Chlorides <sup>(nac)</sup> (mg $\text{Cl}/\text{l}$ )	<2.0	<2.0	<2.0	<0.075	<1.5
Sulphates <sup>(nac)</sup> (mg $\text{SO}_4/\text{l}$ )	<2.0	<2.0	<2.0	<0.075	<1.5
Ammonium <sup>(nac)</sup> (mg $\text{NH}_4/\text{l}$ )	<0.08	<0.08	<0.08	<0.003	<0.06
Calcium (mg $\text{Ca}/\text{l}$ )	<0.10	<0.10	<0.10	<0.0037	<0.074
Magnesium (mg $\text{Mg}/\text{l}$ )	<0.10	<0.10	<0.10	<0.0037	<0.074
Sodium (mg $\text{Na}/\text{l}$ )	<0.30	<0.30	<0.30	<0.011	<0.22
Antimony (mg $\text{Sb}/\text{l}$ )	<0.00050	<0.00050	<0.00050	<0.000019	<0.00038
Arsenic (mg $\text{As}/\text{l}$ )	<0.0010	<0.0010	<0.0010	<0.000037	<0.00074
Boron (mg $\text{B}/\text{l}$ )	<0.020	<0.020	<0.020	<0.00075	<0.015
Cadmium (mg $\text{Cd}/\text{l}$ )	<0.00050	<0.00050	<0.00050	<0.000019	<0.00038
Chromium (mg $\text{Cr}/\text{l}$ )	<0.0010	<0.0010	<0.0010	<0.000037	<0.00074
Copper (mg $\text{Cu}/\text{l}$ )	<0.020	<0.020	<0.020	<0.00075	<0.015
Lead (mg $\text{Pb}/\text{l}$ )	<0.0010	<0.0010	<0.0010	<0.000037	<0.00074
Mercury (mg $\text{Hg}/\text{l}$ )	<0.00010	<0.00010	<0.00010	<0.0000037	<0.000074
Nickel (mg $\text{Ni}/\text{l}$ )	<0.0010	<0.0010	<0.0010	<0.000037	<0.00074
Selenium (mg $\text{Se}/\text{l}$ )	<0.0010	<0.0010	<0.0010	<0.000037	<0.00074
Aluminium (mg $\text{Al}/\text{l}$ )	<0.010	<0.010	<0.010	<0.00037	<0.0074
Iron (mg $\text{Fe}/\text{l}$ )	<0.010	<0.010	<0.010	<0.00037	<0.0074
Manganese <sup>(nac)</sup> (mg $\text{Mn}/\text{l}$ )	<0.005	<0.005	<0.005	<0.0002	<0.004
Total organic carbon (mg $\text{C}/\text{l}$ )	<2.5	<2.5	<2.5	<0.093	<1.9
Acrylamide <sup>(nac)</sup> (mg/l)	<0.00013	<0.00013	<0.00013	<0.0000048	<0.000096
1,2-Dichlorethane (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000093	<0.00019
Vinyl chloride <sup>(nac)</sup> (mg/l)	<0.00013	<0.00013	<0.00013	<0.0000048	<0.000096
Epichlorohydrin <sup>(nac)</sup> (mg/l)	<0.00013	<0.00013	<0.00013	<0.0000048	<0.000096

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9/24

Parameter (Unit)	$a_3^T$	$b_3^T$	$c_3^T$	$M_3^T$ (mg dm <sup>-2</sup> d <sup>-1</sup> )	$C_{tap_3^T}$ (mg/l)
Benzene (mg/l)	<0.00013	<0.00013	<0.00013	<0.0000048	<0.000096
Trichloroethylene (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000093	<0.00019
Tetrachloroethylene (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000093	<0.00019
Trihalomethanes:					
Chloroform (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000093	<0.00019
Bromodichloromethane (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000093	<0.00019
Dibromochloromethane (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000093	<0.00019
Bromoform (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000093	<0.00019
Polycyclic aromatic hydrocarbons:					
Benzo(a)pyrene (mg/l)	<0.000010	<0.000010	<0.000010	<0.00000037	<0.0000074
Benzo(b)fluoranthene (mg/l)	<0.000010	<0.000010	<0.000010	<0.00000037	<0.0000074
Benzo(g,h,i)perylene (mg/l)	<0.000010	<0.000010	<0.000010	<0.00000037	<0.0000074
Benzo(k)fluoranthene (mg/l)	<0.000010	<0.000010	<0.000010	<0.00000037	<0.0000074
Indene(1,2,3-cd)pyrene (mg/l)	<0.000010	<0.000010	<0.000010	<0.00000037	<0.0000074

T – Migration temperature.

$a_3^T$  – Concentration of the measured substance in the water of the 3<sup>rd</sup> migration.

$b_3^T$  – Concentration of the measured substance in the blank water of the 3<sup>rd</sup> migration.

$c_3^T$  – Concentration of the measured substance ( $a_3^T - b_3^T$ ) in the 3<sup>rd</sup> migration.

$M_3^T$  – Migration rate expressed as a function of the concentration unit of the analysed parameter (mg) by area unit and by day of migration (dm<sup>-2</sup>d<sup>-1</sup>).

$C_{tap_3^T}$  – Concentration of the substance in the tap water (mg/l), representative of a real situation, obtained after the conversion of the migration speed in the 3<sup>rd</sup> migration through the use of the conversion factor corresponding to the product under test (20 day.dm<sup>-1</sup>).

< x – The results expressed in this form, indicate that the result is inferior to the [Quantification Limit (x) - Uncertainty].

≤ x – The results expressed in this form, indicate that the result falls within the range defined by [Quantification Limit (x) ± Uncertainty].

The Tests marked with <sup>(nac)</sup> are not included in the scope of accreditation.

<sup>(1)</sup> For the purposes of interpreting the result of the determination of free chlorine, within the scope of the Portuguese “Decreto-Lei nº 69/2023, de 21 de agosto”, this corresponds to the residual disinfectant parameter, not included in the scope of accreditation.

## 4 - Migration tests performed using chlorinated water and non-chlorinated water at 23°C

Migration tests for the organoleptic evaluation of the water and for the evaluation of the migration of substances into the water, at a temperature of 23°C, were performed using chlorinated water and non-chlorinated water under the conditions described in sections 4.1 and 4.2, respectively. The migration tests to evaluate the migration of substances to water at a temperature of 23°C were carried out with chlorinated water under the conditions described in point 4.3. The results obtained are also presented.

#### 4.1 - Migration tests for the organoleptic evaluation of water (performed using chlorinated water at 23°C)

The migration tests for the organoleptic evaluation of water were performed using chlorinated water at 23°C under the conditions and on the dates shown in Tables 12 and 13. The results obtained for the migration water and the blank water for the three migration periods are presented in Tables 14, 15 and 16. The analytical methods applied to the migration waters are presented in Annex A (Table A1).

**Table 12:** Conditions of the migration tests for the organoleptic evaluation, using chlorinated water at 23°C, for the sample with reference “TERRAIN SDP PB 15 x 1,7 mm” (Itecons reference QUI779A/23), corresponding to polybutene pipes

Conditions of the migration tests	
Test method	QUI.12.IE.01, Version: 2 (Feb/18) equivalent to EN 1420:2016 <sup>(nac)</sup> QUI.13.IE.01, Version: 3 (Aug/2021) equivalent to EN 13052-1:2001
Number of test pieces tested	22
Total superficial area – S (dm <sup>2</sup> )	16.86
Test water used	Ultrapure chlorinated water (1 ± 0.2 mg/l Cl <sub>2</sub> )
Volume of the test water – V (l)	0.7
Ratio S/V (dm <sup>-1</sup> )	24.08
Migration temperature – T (° C)	23 ± 2
Duration of each migration period (h)	72 ± 1
Number of migration periods	3
Test start date	11-09-2023
Test completion date	21-09-2023

Tests marked with <sup>(nac)</sup> are not included in the scope of accreditation.

"QUI.xx.IE.xx" corresponds to the internal method of Itecons. The equivalent internal method shall be that which meets the performance characteristics and obtains results that are comparable to the standard method(s) listed therein.

**Table 13:** Dates of the migration tests for the organoleptic evaluation, using chlorinated water at 23°C, for the sample with reference “TERRAIN SDP PB 15 x 1,7 mm” (Itecons reference QUI779A/23), corresponding to polybutene pipes

	Migration test		Physicochemical tests	
	Start	End	Start	End
Pre-treatment	11-09-2023	12-09-2023	---	---
1 <sup>a</sup> Migration	12-09-2023	15-09-2023	15-09-2023	19-09-2023
2 <sup>a</sup> Migration	15-09-2023	18-09-2023	19-09-2023	21-09-2023
3 <sup>a</sup> Migration	18-09-2023	21-09-2023	22-09-2023	25-09-2023

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11/24



**Table 14:** Results obtained for the 1<sup>st</sup> migration for the organoleptic evaluation, using chlorinated water at 23°C, for the migration water and for the blank water

Parameter (Unit)	$a_1^T$	$b_1^T$	$c_1^T$
Odour, at 23°C <sup>(nac)</sup> (Dilution Factor)	<1	<1	<1
Flavour, at 23°C <sup>(nac)</sup> (Dilution Factor)	<1	<1	<1
Colour (mg PtCo/l)	<5	<5	<5
Turbidity (NTU)	<0.50	<0.50	<0.50

T – Migration temperature.

$a_1^T$  – Concentration of the measured substance in the water of the 1<sup>st</sup> migration.

$b_1^T$  – Concentration of the measured substance in the blank water of the 1<sup>st</sup> migration.

$c_1^T$  – Concentration of the measured substance ( $a_1^T - b_1^T$ ) in the 1<sup>st</sup> migration.

< x – The results expressed in this form, indicate that the result is inferior to the [Quantification Limit (x) - Uncertainty], except for the odour and flavour parameters, in which the formulation < x means that there is an absence of perception for a dilution factor of x.

≤ x – The results expressed in this form, indicate that the result falls within the range defined by [Quantification Limit (x) ± Uncertainty].

The tests marked with <sup>(nac)</sup> are not included in the scope of accreditation.

**Table 15:** Results obtained for the 2<sup>nd</sup> migration for the organoleptic evaluation, using chlorinated water at 23°C, for the migration water and for the blank water

Parameter (Unit)	$a_2^T$	$b_2^T$	$c_2^T$
Odour, at 23°C <sup>(nac)</sup> (Dilution Factor)	<1	<1	<1
Flavour, at 23°C <sup>(nac)</sup> (Dilution Factor)	<1	<1	<1
Colour (mg PtCo/l)	<5	<5	<5
Turbidity (NTU)	<0.50	<0.50	<0.50

T – Migration temperature.

$a_2^T$  – Concentration of the measured substance in the water of the 2<sup>nd</sup> migration.

$b_2^T$  – Concentration of the measured substance in the blank water of the 2<sup>nd</sup> migration.

$c_2^T$  – Concentration of the measured substance ( $a_2^T - b_2^T$ ) in the 2<sup>nd</sup> migration.

< x – The results expressed in this form, indicate that the result is inferior to the [Quantification Limit (x) - Uncertainty], except for the odour and flavour parameters, in which the formulation < x means that there is an absence of perception for a dilution factor of x.

≤ x – The results expressed in this form, indicate that the result falls within the range defined by [Quantification Limit (x) ± Uncertainty].

The tests marked with <sup>(nac)</sup> are not included in the scope of accreditation.

**Table 16:** Results obtained for the 3<sup>rd</sup> migration for the organoleptic evaluation, using chlorinated water at 23°C, for the migration water and for the blank water

Parameter (Unit)	$a_3^T$	$b_3^T$	$c_3^T$
Odour, at 23°C <sup>(nac)</sup> (Dilution Factor)	<1	<1	<1
Flavour, at 23°C <sup>(nac)</sup> (Dilution Factor)	<1	<1	<1
Colour (mg PtCo/l)	<5	<5	<5
Turbidity (NTU)	<0.50	<0.50	<0.50

T – Migration temperature.

$a_3^T$  – Concentration of the measured substance in the water of the 3<sup>rd</sup> migration.

$b_3^T$  – Concentration of the measured substance in the blank water of the 3<sup>rd</sup> migration.

$c_3^T$  – Concentration of the measured substance ( $a_3^T - b_3^T$ ) in the 3<sup>rd</sup> migration.

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$< x$  – The results expressed in this form, indicate that the result is inferior to the [Quantification Limit ( $x$ ) - Uncertainty], except for the odour and flavour parameters, in which the formulation  $< x$  means that there is an absence of perception for a dilution factor of  $x$ .

$\leq x$  – The results expressed in this form, indicate that the result falls within the range defined by [Quantification Limit ( $x$ )  $\pm$  Uncertainty].

The tests marked with <sup>(nac)</sup> are not included in the scope of accreditation.

## 4.2 - Migration tests for the organoleptic evaluation of water (performed using non-chlorinated water at 23°C)

The migration tests for the organoleptic evaluation of water were performed using non-chlorinated water at 23°C under the conditions and on the dates shown in Tables 17 and 18. The results obtained for the migration water and the blank water for the three migration periods are presented in Tables 19, 20 and 21. The analytical methods applied to the migration waters are presented in Annex A (Table A1).

**Table 17:** Conditions of the migration tests for the organoleptic evaluation, using non-chlorinated water at 23°C, for the sample with reference "TERRAIN SDP PB 15 x 1,7 mm" (Itecons reference QUI779A/23), corresponding to polybutene pipes

	Conditions of the migration tests
Test method	QUI.12.IE.01, Version: 2 (Feb/18) equivalent to EN 1420:2016 <sup>(nac)</sup> QUI.13.IE.01, Version: 3 (Aug/2021) equivalent to EN 13052-1:2001
Number of test pieces tested	22
Total superficial area – S (dm <sup>2</sup> )	16.86
Test water used	Ultrapure water
Volume of the test water – V (l)	0.7
Ratio S/V (dm <sup>-1</sup> )	24.08
Migration temperature – T (° C)	23 $\pm$ 2
Duration of each migration period (h)	72 $\pm$ 1
Number of migration periods	3
Test start date	11-09-2023
Test completion date	21-09-2023

Tests marked with <sup>(nac)</sup> are not included in the scope of accreditation.

"QUI.xx.IE.xx" corresponds to the internal method of Itecons. The equivalent internal method shall be that which meets the performance characteristics and obtains results that are comparable to the standard method(s) listed therein.

**Table 18:** Dates of the migration tests for the organoleptic evaluation, using non-chlorinated water at 23°C, for the sample with reference “TERRAIN SDP PB 15 x 1,7 mm” (Itecons reference QUI779A/23), corresponding to polybutene pipes

	Migration test		Physicochemical tests	
	Start	End	Start	End
Pre-treatment	11-09-2023	12-09-2023	---	---
1 <sup>a</sup> Migration	12-09-2023	15-09-2023	15-09-2023	19-09-2023
2 <sup>a</sup> Migration	15-09-2023	18-09-2023	19-09-2023	21-09-2023
3 <sup>a</sup> Migration	18-09-2023	21-09-2023	22-09-2023	25-09-2023

**Table 19:** Results obtained for the 1<sup>st</sup> migration for the organoleptic evaluation, using non-chlorinated water at 23°C, for the migration water and for the blank water

Parameter (Unit)	$a_1^T$	$b_1^T$	$c_1^T$
Odour, at 23°C <sup>(nac)</sup> (Dilution Factor)	<1	<1	<1
Flavour, at 23°C <sup>(nac)</sup> (Dilution Factor)	<1	<1	<1
Colour (mg PtCo/l)	<5	<5	<5
Turbidity (NTU)	<0.50	<0.50	<0.50

T – Migration temperature.

$a_1^T$  – Concentration of the measured substance in the water of the 1<sup>st</sup> migration.

$b_1^T$  – Concentration of the measured substance in the blank water of the 1<sup>st</sup> migration.

$c_1^T$  – Concentration of the measured substance ( $a_1^T - b_1^T$ ) in the 1<sup>st</sup> migration.

< x – The results expressed in this form, indicate that the result is inferior to the [Quantification Limit (x) - Uncertainty], except for the odour and flavour parameters, in which the formulation < x means that there is an absence of perception for a dilution factor of x.

≤ x – The results expressed in this form, indicate that the result falls within the range defined by [Quantification Limit (x) ± Uncertainty].

The tests marked with <sup>(nac)</sup> are not included in the scope of accreditation.

**Table 20:** Results obtained for the 2<sup>nd</sup> migration for the organoleptic evaluation, using non-chlorinated water at 23°C, for the migration water and for the blank water

Parameter (Unit)	$a_2^T$	$b_2^T$	$c_2^T$
Odour, at 23°C <sup>(nac)</sup> (Dilution Factor)	<1	<1	<1
Flavour, at 23°C <sup>(nac)</sup> (Dilution Factor)	<1	<1	<1
Colour (mg PtCo/l)	<5	<5	<5
Turbidity (NTU)	<0.50	<0.50	<0.50

T – Migration temperature.

$a_2^T$  – Concentration of the measured substance in the water of the 2<sup>nd</sup> migration.

$b_2^T$  – Concentration of the measured substance in the blank water of the 2<sup>nd</sup> migration.

$c_2^T$  – Concentration of the measured substance ( $a_2^T - b_2^T$ ) in the 2<sup>nd</sup> migration.

< x – The results expressed in this form, indicate that the result is inferior to the [Quantification Limit (x) - Uncertainty], except for the odour and flavour parameters, in which the formulation < x means that there is an absence of perception for a dilution factor of x.

≤ x – The results expressed in this form, indicate that the result falls within the range defined by [Quantification Limit (x) ± Uncertainty].

The tests marked with <sup>(nac)</sup> are not included in the scope of accreditation.

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**Table 21:** Results obtained for the 3<sup>rd</sup> migration for the organoleptic evaluation, using non-chlorinated water at 23°C, for the migration water and for the blank water

Parameter (Unit)	$a_3^T$	$b_3^T$	$c_3^T$
Odour, at 23°C <sup>(nac)</sup> (Dilution Factor)	<1	<1	<1
Flavour, at 23°C <sup>(nac)</sup> (Dilution Factor)	<1	<1	<1
Colour (mg PtCo/l)	<5	<5	<5
Turbidity (NTU)	<0.50	<0.50	<0.50

T – Migration temperature.

$a_3^T$  – Concentration of the measured substance in the water of the 3<sup>rd</sup> migration.

$b_3^T$  – Concentration of the measured substance in the blank water of the 3<sup>rd</sup> migration.

$c_3^T$  – Concentration of the measured substance ( $a_3^T - b_3^T$ ) in the 3<sup>rd</sup> migration.

< x – The results expressed in this form, indicate that the result is inferior to the [Quantification Limit (x) - Uncertainty], except for the odour and flavour parameters, in which the formulation < x means that there is an absence of perception for a dilution factor of x.

≤ x – The results expressed in this form, indicate that the result falls within the range defined by [Quantification Limit (x) ± Uncertainty].

The tests marked with <sup>(nac)</sup> are not included in the scope of accreditation.

### 4.3 - Migration tests for the evaluation of the migration of substances into the water (performed using chlorinated water at 23°C)

The migration tests for the evaluation of the migration of substances into the water were performed using chlorinated water, at a temperature of 23°C, under the conditions and on the dates shown in Tables 22 and 23. The results obtained for the migration water and the blank for the three migration periods are presented in Tables 24, 25 and 26. The analytical methods applied to the migration waters are presented in Annex A (Table A1).

**Table 22:** Conditions of the migration tests for the evaluation of the migration of substances, using chlorinated water at 23°C, for the sample with reference “TERRAIN SDP PB 15 x 1,7 mm” (Itecons reference QUI779A/23), corresponding to polybutene pipes

	Conditions of the migration tests
Test method	QUI.11.IE.01, Versão: 5 (May/2020) equivalent to EN 12873-1:2014
Number of samples/specimens tested	44
Total superficial area – S (dm <sup>2</sup> )	33.72
Test water used	Ultrapure chlorinated water (1 ± 0.2 mg/l Cl <sub>2</sub> )
Volume of the test water – V (l)	2.5
Ratio S/V (dm <sup>-1</sup> )	13.49
Migration temperature – T (°C)	23 ± 2
Duration of each migration period (h)	72 ± 1

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15/24

Number of migration periods	3
Test start date	11-09-2023
Test completion date	21-09-2023

"QUI.xx.IE.xx" corresponds to the internal method of Itecons. The equivalent internal method shall be that which meets the performance characteristics and obtains results that are comparable to the standard method(s) listed therein.

**Table 23:** Dates of the migration tests for the evaluation of the migration of substances, using chlorinated water at 23°C, for the sample with reference "TERRAIN SDP PB 15 x 1,7 mm" (Itecons reference QUI779A/23), corresponding to polybutene pipes

	Migration test		Physicochemical tests	
	Start	End	Start	End
Pre-treatment	11-09-2023	12-09-2023	---	---
1 <sup>a</sup> Migration	12-09-2023	15-09-2023	15-09-2023	25-10-2023
2 <sup>a</sup> Migration	15-09-2023	18-09-2023	18-09-2023	25-10-2023
3 <sup>a</sup> Migration	18-09-2023	21-09-2023	21-09-2023	25-10-2023

**Table 24:** Results obtained for the 1<sup>st</sup> migration for the evaluation of the migration of substances, using chlorinated water at 23°C, for the migration water and for the blank water

Parameter (Unit)	a <sub>1</sub> <sup>T</sup>	b <sub>1</sub> <sup>T</sup>	c <sub>1</sub> <sup>T</sup>	M <sub>1</sub> <sup>T</sup> (mg dm <sup>-2</sup> d <sup>-1</sup> )	Ctap <sub>1</sub> <sup>T</sup> (mg/l)
pH (measuring temperature)	6.9 (19°C)	6.9 (19°C)	6.9 (19°C)	---	---
Conductivity, at 20°C (µS/cm)	<9.0	<9.0	<9.0	---	---
Free chlorine <sup>(1)</sup> (mg Cl <sub>2</sub> /l)	0.7	0.9	<0.10	<0.0025	<0.050
Cyanides (mg CN/l)	<0.005	<0.005	<0.005	<0.0001	<0.002
Bromates <sup>(nac)</sup> (mg BrO <sub>3</sub> /l)	<0.0020	<0.0020	<0.0020	<0.000049	<0.00098
Fluorides <sup>(nac)</sup> (mg F/l)	<0.20	<0.20	<0.20	<0.0049	<0.098
Nitrates <sup>(nac)</sup> (mg NO <sub>3</sub> /l)	<1.0	<1.0	<1.0	<0.025	<0.50
Chlorides <sup>(nac)</sup> (mg Cl/l)	≤2.0	≤2.0	<2.0	<0.049	<0.98
Sulphates <sup>(nac)</sup> (mg SO <sub>4</sub> /l)	<2.0	<2.0	<2.0	<0.049	<0.98
Ammonium <sup>(nac)</sup> (mg NH <sub>4</sub> /l)	<0.10	<0.10	<0.10	<0.0025	<0.050
Calcium (mg Ca/l)	<0.10	<0.10	<0.10	<0.0025	<0.050
Magnesium (mg Mg/l)	<0.10	<0.10	<0.10	<0.0025	<0.050
Sodium (mg Na/l)	1.3	1.2	<0.30	<0.0074	<0.15
Antimony (mg Sb/l)	<0.00050	<0.00050	<0.00050	<0.000012	<0.00024
Arsenic (mg As/l)	<0.0010	<0.0010	<0.0010	<0.000025	<0.00050
Boron (mg B/l)	<0.020	<0.020	<0.020	<0.00049	<0.0098
Cadmium (mg Cd/l)	<0.00050	<0.00050	<0.00050	<0.000012	<0.00024
Chromium (mg Cr/l)	<0.0010	<0.0010	<0.0010	<0.000025	<0.00050

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Parameter (Unit)	$a_1^T$	$b_1^T$	$c_1^T$	$M_1^T$ (mg dm <sup>-2</sup> d <sup>-1</sup> )	$C_{tap_1^T}$ (mg/l)
Copper (mg Cu/l)	<0.020	<0.020	<0.020	<0.00049	<0.0098
Lead (mg Pb/l)	<0.0010	<0.0010	<0.0010	<0.000025	<0.00050
Mercury (mg Hg/l)	<0.00010	<0.00010	<0.00010	<0.0000025	<0.000050
Nickel (mg Ni/l)	<0.0010	<0.0010	<0.0010	<0.000025	<0.00050
Selenium (mg Se/l)	<0.0010	<0.0010	<0.0010	<0.000025	<0.00050
Aluminium (mg Al/l)	<0.010	<0.010	<0.010	<0.00025	<0.0050
Iron (mg Fe/l)	<0.010	<0.010	<0.010	<0.00025	<0.0050
Manganese (mg Mn/l)	<0.010	<0.010	<0.010	<0.00025	<0.0050
Total organic carbon (mg C/l)	<2.5	<2.5	<2.5	<0.062	<1.2
Acrylamide <sup>(nac)</sup> (mg/l)	<0.00013	<0.00013	<0.00013	<0.0000032	<0.000064
1,2-Dichlorethane (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000062	<0.00012
Vinyl chloride <sup>(nac)</sup> (mg/l)	<0.00013	<0.00013	<0.00013	<0.0000032	<0.000064
Epichlorohydrin <sup>(nac)</sup> (mg/l)	<0.00013	<0.00013	<0.00013	<0.0000032	<0.000064
Benzene (mg/l)	<0.00013	<0.00013	<0.00013	<0.0000032	<0.000064
Trichloroethylene (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000062	<0.00012
Tetrachloroethylene (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000062	<0.00012
Trihalomethanes:					
Chloroform (mg/l)	0.0010	0.00036	0.00064	0.000016	0.00032
Bromodichloromethane (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000062	<0.00012
Dibromochloromethane (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000062	<0.00012
Bromoform (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000062	<0.00012
Polycyclic aromatic hydrocarbons:					
Benzo(a)pyrene (mg/l)	<0.000010	<0.000010	<0.000010	<0.00000025	<0.0000050
Benzo(b)fluoranthene (mg/l)	<0.000010	<0.000010	<0.000010	<0.00000025	<0.0000050
Benzo(g,h,i)perylene (mg/l)	<0.000010	<0.000010	<0.000010	<0.00000025	<0.0000050
Benzo(k)fluoranthene (mg/l)	<0.000010	<0.000010	<0.000010	<0.00000025	<0.0000050
Indene(1,2,3-cd)pyrene (mg/l)	<0.000010	<0.000010	<0.000010	<0.00000025	<0.0000050

T – Migration temperature.

$a_1^T$  – Concentration of the measured substance in the water of the 1<sup>st</sup> migration.

$b_1^T$  – Concentration of the measured substance in the blank water of the 1<sup>st</sup> migration.

$c_1^T$  – Concentration of the measured substance ( $a_1^T - b_1^T$ ) in the 1<sup>st</sup> migration.

$M_1^T$  – Migration rate expressed as a function of the concentration unit of the analysed parameter (mg) by area unit and by day of migration (dm<sup>-2</sup>d<sup>-1</sup>).

$C_{tap_1^T}$  – Concentration of the substance in the tap water (mg/l), representative of a real situation, obtained after the conversion of the migration rate in the 1<sup>st</sup> migration through the use of the conversion factor corresponding to the product under test (20 day.dm<sup>-1</sup>).

< x – The results expressed in this form, indicate that the result is inferior to the [Quantification Limit (x) - Uncertainty].

≤ x – The results expressed in this form, indicate that the result falls within the range defined by [Quantification Limit (x) ± Uncertainty].

The Tests marked with <sup>(nac)</sup> are not included in the scope of accreditation.

<sup>(1)</sup> For the purposes of interpreting the result of the determination of free chlorine, within the scope of the Portuguese “Decreto-Lei nº 69/2023, de 21 de agosto”, this corresponds to the residual disinfectant parameter, not included in the scope of accreditation.

**Table 25:** Results obtained for the 2<sup>nd</sup> migration for the evaluation of the migration of substances, using chlorinated water at 23°C, for the migration water and for the blank water

Parameter (Unit)	a <sub>2</sub> <sup>T</sup>	b <sub>2</sub> <sup>T</sup>	c <sub>2</sub> <sup>T</sup>	M <sub>2</sub> <sup>T</sup> (mg dm <sup>-2</sup> d <sup>-1</sup> )	Ctap <sub>2</sub> <sup>T</sup> (mg/l)
pH (measuring temperature)	6.9 (20°C)	6.9 (20°C)	6.9 (20°C)	---	---
Conductivity, at 20°C (µS/cm)	<9.0	<9.0	<9.0	---	---
Free chlorine <sup>(1)</sup> (mg Cl <sub>2</sub> /l)	0.8	0.9	<0.10	<0.0025	<0.050
Cyanides (mg CN/l)	<0.005	<0.005	<0.005	<0.0001	<0.002
Bromates <sup>(nac)</sup> (mg BrO <sub>3</sub> /l)	<0.0020	<0.0020	<0.0020	<0.000049	<0.00098
Fluorides <sup>(nac)</sup> (mg F/l)	<0.20	<0.20	<0.20	<0.0049	<0.098
Nitrates <sup>(nac)</sup> (mg NO <sub>3</sub> /l)	<1.0	<1.0	<1.0	<0.025	<0.50
Chlorides <sup>(nac)</sup> (mg Cl/l)	≤2.0	≤2.0	<2.0	<0.049	<0.98
Sulphates <sup>(nac)</sup> (mg SO <sub>4</sub> /l)	<2.0	<2.0	<2.0	<0.049	<0.98
Ammonium <sup>(nac)</sup> (mg NH <sub>4</sub> /l)	<0.10	<0.10	<0.10	<0.0025	<0.050
Calcium (mg Ca/l)	<0.10	<0.10	<0.10	<0.0025	<0.050
Magnesium (mg Mg/l)	<0.10	<0.10	<0.10	<0.0025	<0.050
Sodium (mg Na/l)	1.2	1.2	<0.30	<0.0074	<0.15
Antimony (mg Sb/l)	<0.00050	<0.00050	<0.00050	<0.000012	<0.00024
Arsenic (mg As/l)	<0.0010	<0.0010	<0.0010	<0.000025	<0.00050
Boron (mg B/l)	<0.020	<0.020	<0.020	<0.00049	<0.0098
Cadmium (mg Cd/l)	<0.00050	<0.00050	<0.00050	<0.000012	<0.00024
Chromium (mg Cr/l)	<0.0010	<0.0010	<0.0010	<0.000025	<0.00050
Copper (mg Cu/l)	<0.020	<0.020	<0.020	<0.00049	<0.0098
Lead (mg Pb/l)	<0.0010	<0.0010	<0.0010	<0.000025	<0.00050
Mercury (mg Hg/l)	<0.00010	<0.00010	<0.00010	<0.0000025	<0.000050
Nickel (mg Ni/l)	<0.0010	<0.0010	<0.0010	<0.000025	<0.00050
Selenium (mg Se/l)	<0.0010	<0.0010	<0.0010	<0.000025	<0.00050
Aluminium (mg Al/l)	<0.010	<0.010	<0.010	<0.00025	<0.0050
Iron (mg Fe/l)	<0.010	<0.010	<0.010	<0.00025	<0.0050
Manganese (mg Mn/l)	<0.010	<0.010	<0.010	<0.00025	<0.0050
Total organic carbon (mg C/l)	<2.5	<2.5	<2.5	<0.062	<1.2
Acrylamide <sup>(nac)</sup> (mg/l)	<0.00013	<0.00013	<0.00013	<0.0000032	<0.000064
1,2-Dichlorethane (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000062	<0.00012
Vinyl chloride <sup>(nac)</sup> (mg/l)	<0.00013	<0.00013	<0.00013	<0.0000032	<0.000064
Epichlorohydrin <sup>(nac)</sup> (mg/l)	<0.00013	<0.00013	<0.00013	<0.0000032	<0.000064
Benzene (mg/l)	<0.00013	<0.00013	<0.00013	<0.0000032	<0.000064
Trichloroethylene (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000062	<0.00012
Tetrachloroethylene (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000062	<0.00012
Trihalomethanes:					
Chloroform (mg/l)	0.00060	≤0.00025	0.00043	0.000011	0.00022
Bromodichloromethane (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000062	<0.00012
Dibromochloromethane (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000062	<0.00012
Bromoform (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000062	<0.00012
Polycyclic aromatic hydrocarbons:					

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18/24

Parameter (Unit)	$a_2^T$	$b_2^T$	$c_2^T$	$M_2^T$ (mg dm <sup>-2</sup> d <sup>-1</sup> )	$C_{tap2}^T$ (mg/l)
Benzo(a)pyrene (mg/l)	<0.000010	<0.000010	<0.000010	<0.00000025	<0.0000050
Benzo(b)fluoranthene (mg/l)	<0.000010	<0.000010	<0.000010	<0.00000025	<0.0000050
Benzo(g,h,i)perylene (mg/l)	<0.000010	<0.000010	<0.000010	<0.00000025	<0.0000050
Benzo(k)fluoranthene (mg/l)	<0.000010	<0.000010	<0.000010	<0.00000025	<0.0000050
Indene(1,2,3-cd)pyrene (mg/l)	<0.000010	<0.000010	<0.000010	<0.00000025	<0.0000050

T – Migration temperature.

$a_2^T$  – Concentration of the measured substance in the water of the 2<sup>nd</sup> migration.

$b_2^T$  – Concentration of the measured substance in the blank water of the 2<sup>nd</sup> migration.

$c_2^T$  – Concentration of the measured substance ( $a_2^T - b_2^T$ ) in the 2<sup>nd</sup> migration.

$M_2^T$  – Migration rate expressed as a function of the concentration unit of the analysed parameter (mg) by area unit and by day of migration (dm<sup>-2</sup>d<sup>-1</sup>).

$C_{tap2}^T$  – Concentration of the substance in the tap water (mg/l), representative of a real situation, obtained after the conversion of the migration speed in the 2<sup>nd</sup> migration through the use of the conversion factor corresponding to the product under test (20 day.dm<sup>-1</sup>).

< x – The results expressed in this form, indicate that the result is inferior to the [Quantification Limit (x) - Uncertainty].

≤ x – The results expressed in this form, indicate that the result falls within the range defined by [Quantification Limit (x) ± Uncertainty].

The Tests marked with <sup>(nac)</sup> are not included in the scope of accreditation.

<sup>(1)</sup> For the purposes of interpreting the result of the determination of free chlorine, within the scope of the Portuguese “Decreto-Lei nº 69/2023, de 21 de agosto”, this corresponds to the residual disinfectant parameter, not included in the scope of accreditation.

**Table 26:** Results obtained for the 3<sup>rd</sup> migration for the evaluation of the migration of substances, using chlorinated water at 23°C, for the migration water and for the blank water

Parameter (Unit)	$a_3^T$	$b_3^T$	$c_3^T$	$M_3^T$ (mg dm <sup>-2</sup> d <sup>-1</sup> )	$C_{tap3}^T$ (mg/l)
pH (measuring temperature)	6.6 (21°C)	6.8 (22°C)	6.6 (21°C)	---	---
Conductivity, at 20°C (µS/cm)	<9.0	<9.0	<9.0	---	---
Free chlorine <sup>(1)</sup> (mg Cl <sub>2</sub> /l)	0.8	0.9	<0.10	<0.0025	<0.050
Cyanides (mg CN/l)	<0.005	<0.005	<0.005	<0.0001	<0.002
Bromates <sup>(nac)</sup> (mg BrO <sub>3</sub> /l)	<0.0020	<0.0020	<0.0020	<0.000049	<0.00098
Fluorides <sup>(nac)</sup> (mg F/l)	<0.20	<0.20	<0.20	<0.0049	<0.098
Nitrates <sup>(nac)</sup> (mg NO <sub>3</sub> /l)	<1.0	<1.0	<1.0	<0.025	<0.50
Chlorides <sup>(nac)</sup> (mg Cl/l)	<2.0	<2.0	<2.0	<0.049	<0.98
Sulphates <sup>(nac)</sup> (mg SO <sub>4</sub> /l)	<2.0	<2.0	<2.0	<0.049	<0.98
Ammonium <sup>(nac)</sup> (mg NH <sub>4</sub> /l)	<0.10	<0.10	<0.10	<0.0025	<0.050
Calcium (mg Ca/l)	<0.10	<0.10	<0.10	<0.0025	<0.050
Magnesium (mg Mg/l)	<0.10	<0.10	<0.10	<0.0025	<0.050
Sodium (mg Na/l)	1.2	1.2	<0.30	<0.0074	<0.15
Antimony (mg Sb/l)	<0.00050	<0.00050	<0.00050	<0.000012	<0.00024
Arsenic (mg As/l)	<0.0010	<0.0010	<0.0010	<0.000025	<0.00050
Boron (mg B/l)	<0.020	<0.020	<0.020	<0.00049	<0.0098
Cadmium (mg Cd/l)	<0.00050	<0.00050	<0.00050	<0.000012	<0.00024
Chromium (mg Cr/l)	<0.0010	<0.0010	<0.0010	<0.000025	<0.00050
Copper (mg Cu/l)	<0.020	<0.020	<0.020	<0.00049	<0.0098
Lead (mg Pb/l)	<0.0010	<0.0010	<0.0010	<0.000025	<0.00050
Mercury (mg Hg/l)	<0.00010	<0.00010	<0.00010	<0.0000025	<0.000050
Nickel (mg Ni/l)	<0.0010	<0.0010	<0.0010	<0.000025	<0.00050

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19/24



Parameter (Unit)	$a_3^T$	$b_3^T$	$c_3^T$	$M_3^T$ (mg dm <sup>-2</sup> d <sup>-1</sup> )	$C_{tap3}^T$ (mg/l)
Selenium (mg Se/l)	<0.0010	<0.0010	<0.0010	<0.000025	<0.00050
Aluminium (mg Al/l)	<0.010	<0.010	<0.010	<0.00025	<0.0050
Iron (mg Fe/l)	<0.010	<0.010	<0.010	<0.00025	<0.0050
Manganese (mg Mn/l)	<0.010	<0.010	<0.010	<0.00025	<0.0050
Total organic carbon (mg C/l)	<2.5	<2.5	<2.5	<0.062	<1.2
Acrylamide <sup>(nac)</sup> (mg/l)	<0.00013	<0.00013	<0.00013	<0.0000032	<0.000064
1,2-Dichlorethane (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000062	<0.00012
Vinyl chloride <sup>(nac)</sup> (mg/l)	<0.00013	<0.00013	<0.00013	<0.0000032	<0.000064
Epichlorohydrin <sup>(nac)</sup> (mg/l)	<0.00013	<0.00013	<0.00013	<0.0000032	<0.000064
Benzene (mg/l)	<0.00013	<0.00013	<0.00013	<0.0000032	<0.000064
Trichloroethylene (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000062	<0.00012
Tetrachloroethylene (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000062	<0.00012
Trihalomethanes:					
Chloroform (mg/l)	0.00054	≤0.00025	0.00037	0.0000091	0.00018
Bromodichloromethane (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000062	<0.00012
Dibromochloromethane (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000062	<0.00012
Bromoform (mg/l)	<0.00025	<0.00025	<0.00025	<0.0000062	<0.00012
Polycyclic aromatic hydrocarbons:					
Benzo(a)pyrene (mg/l)	<0.000010	<0.000010	<0.000010	<0.00000025	<0.0000050
Benzo(b)fluoranthene (mg/l)	<0.000010	<0.000010	<0.000010	<0.00000025	<0.0000050
Benzo(g,h,i)perylene (mg/l)	<0.000010	<0.000010	<0.000010	<0.00000025	<0.0000050
Benzo(k)fluoranthene (mg/l)	<0.000010	<0.000010	<0.000010	<0.00000025	<0.0000050
Indene(1,2,3-cd)pyrene (mg/l)	<0.000010	<0.000010	<0.000010	<0.00000025	<0.0000050

T – Migration temperature.

$a_3^T$  – Concentration of the measured substance in the water of the 3<sup>rd</sup> migration.

$b_3^T$  – Concentration of the measured substance in the blank water of the 3<sup>rd</sup> migration.

$c_3^T$  – Concentration of the measured substance ( $a_3^T - b_3^T$ ) in the 3<sup>rd</sup> migration.

$M_3^T$  – Migration rate expressed as a function of the concentration unit of the analysed parameter (mg) by area unit and by day of migration (dm<sup>-2</sup>d<sup>-1</sup>).

$C_{tap3}^T$  – Concentration of the substance in the tap water (mg/l), representative of a real situation, obtained after the conversion of the migration speed in the 3<sup>rd</sup> migration through the use of the conversion factor corresponding to the product under test (20 day.dm<sup>-1</sup>).

< x – The results expressed in this form, indicate that the result is inferior to the [Quantification Limit (x) - Uncertainty].

≤ x – The results expressed in this form, indicate that the result falls within the range defined by [Quantification Limit (x) ± Uncertainty].

The Tests marked with <sup>(nac)</sup> are not included in the scope of accreditation.

<sup>(1)</sup> For the purposes of interpreting the result of the determination of free chlorine, within the scope of the Portuguese "Decreto-Lei nº 69/2023, de 21 de agosto", this corresponds to the residual disinfectant parameter, not included in the scope of accreditation.

## 5 - Final considerations

The assessment of the results obtained in the different fractions of migration water, with respect to the organoleptic characteristics of the water and migration of substances into the water, according to the “Decreto-Lei nº 69/2023 de 21 de agosto” and the requirements found in “Annex A” from the “Project of Regulation which lays down the conditions of the Approval Scheme in Portugal for products in contact with water intended for human consumption” of the ERSAR, shows evidence of conformity of the tested product “TERRAIN SDP PB 15 x 1,7 mm” (Itecons reference QUI779A/23) for its proposed use.

*Note: For the purposes of conformity assessment, the uncertainty values associated with the results were not considered. This assessment is outside the scope of accreditation.*

Coimbra, 27<sup>th</sup> October 2023

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Documento validado

## Annex A

**Table A1:** Test methods for the physicochemical tests performed to the migration waters, for the sample with reference “TERRAIN SDP PB 15 x 1,7 mm” (Itecons reference QUI779A/23), corresponding to polybutene pipes

Parameter	Test method
Odour, at 23°C <sup>(nac)</sup>	QUI.14.IE.01, Version: 1 (Jan/16) equivalent to EN 1622:2006
Flavour, at 23°C <sup>(nac)</sup>	QUI.14.IE.01, Version: 1 (Jan/16) equivalent to EN 1622:2006
Colour	QUI.15.IE.01, Version: 3 (Oct/2020) equivalent to ISO 7887:2011 (Method C)
Turbidity	QUI.16.IE.01, Version: 4 (Oct/2020) equivalent to ISO 7027-1:2016 (Section 5.3)
pH	QUI.03.IE.01, Version: 8 (Apr/2023) equivalent to SMEWW 4500-H+ B, 23 <sup>a</sup> Ed.
Conductivity, at 20°C	QUI.17.IE.01, Version: 6 (Apr/2023) equivalent to EN 27888:1993
Free chlorine	QUI.29.IE.01, Version: 4 (Feb/2021) equivalent to ISO 7393-2:2017
Cyanides	QUI.21.IE.01, Version: 3 (Oct/2020) equivalent to SMEWW 4500 CN <sup>-</sup> C, E, 23 <sup>a</sup> Ed.
Bromates <sup>(nac)</sup>	QUI.22.IE.01, Version: 1 (Jan/16) equivalent to ISO 10304-1:2007
Fluorides <sup>(nac)</sup>	QUI.22.IE.01, Version: 1 (Jan/16) equivalent to ISO 10304-1:2007
Nitrates <sup>(nac)</sup>	QUI.22.IE.01, Version: 1 (Jan/16) equivalent to ISO 10304-1:2007
Chlorides <sup>(nac)</sup>	QUI.22.IE.01, Version: 1 (Jan/16) equivalent to ISO 10304-1:2007
Sulphates <sup>(nac)</sup>	QUI.22.IE.01, Version: 1 (Jan/16) equivalent to ISO 10304-1:2007
Ammonium <sup>(nac)</sup>	QUI.24.IE.01, Version: 1 (Jan/16)
Calcium	QUI.02.IE.01, Version: 9 (Aug/2021) equivalent to ISO 11885:2007
Magnesium	QUI.02.IE.01, Version: 9 (Aug/2021) equivalent to ISO 11885:2007
Sodium	QUI.02.IE.01, Version: 9 (Aug/2021) equivalent to ISO 11885:2007
Antimony	QUI.85.IE.01, Version: 5 (Aug/2021) equivalent to ISO 17294-2:2016 (except section 9.2)
Arsenic	QUI.85.IE.01, Version: 5 (Aug/2021) equivalent to ISO 17294-2:2016 (except section 9.2)
Boron <sup>(*)</sup>	QUI.02.IE.01, Version: 9 (Aug/2021) equivalent to ISO 11885:2007 and ISO 15587-2:2002 (microwave -closed vessel)
Cadmium	QUI.85.IE.01, Version: 5 (Aug/2021) equivalent to ISO 17294-2:2016 (except section 9.2)
Chromium	QUI.85.IE.01, Version: 5 (Aug/2021) equivalent to ISO 17294-2:2016 (except section 9.2)
Copper <sup>(*)</sup>	QUI.02.IE.01, Version: 9 (Aug/2021) equivalent to ISO 11885:2007 and ISO 15587-2:2002 (microwave -closed vessel)
Lead	QUI.85.IE.01, Version: 5 (Aug/2021) equivalent to ISO 17294-2:2016 (except section 9.2)
Mercury	QUI.85.IE.01, Version: 5 (Aug/2021) equivalent to ISO 17294-2:2016 (except section 9.2)
Nickel	QUI.85.IE.01, Version: 5 (Aug/2021) equivalent to ISO 17294-2:2016 (except section 9.2)
Selenium	QUI.85.IE.01, Version: 5 (Aug/2021) equivalent to ISO 17294-2:2016 (except section 9.2)
Aluminium <sup>(*)</sup>	QUI.02.IE.01, Version: 9 (Aug/2021) equivalent to ISO 11885:2007 and ISO 15587-2:2002 (microwave -closed vessel)
Iron <sup>(*)</sup>	QUI.02.IE.01, Version: 9 (Aug/2021) equivalent to ISO 11885:2007 and ISO 15587-2:2002 (microwave -closed vessel)
Manganese <sup>(*)</sup>	QUI.02.IE.01, Version: 9 (Aug/2021) equivalent to ISO 11885:2007 and ISO 15587-2:2002 (microwave -closed vessel)
Manganese <sup>(nac)</sup>	QUI.08.IE.01, Version: 1 (Nov/15) equivalent to ISO 11885:2007
Total organic carbon	QUI.01.IE.01, Version: 8 (Apr/2023) equivalent to EN 1484:1997
Acrylamide <sup>(nac)</sup>	QUI.25.IE.01, Version: 1 (Jan/16) equivalent to EPA 8316:1994

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22/24



Parameter	Test method
1,2-Dichlorethane	QUI.26.IE.01, Version: 6 (Nov/2020) equivalent to ISO 20595:2018
Vinyl chloride <sup>(nac)</sup>	QUI.260.IE.01, Version: 1 (Jan/2021) equivalent to ISO 17943:2016
Epichlorohydrin <sup>(nac)</sup>	QUI.260.IE.01, Version: 1 (Jan/2021) equivalent to ISO 17943:2016
Benzene	QUI.26.IE.01, Version: 6 (Nov/2020) equivalent to ISO 20595:2018
Trichloroethylene	QUI.26.IE.01, Version: 6 (Nov/2020) equivalent to ISO 20595:2018
Tetrachloroethylene	QUI.26.IE.01, Version: 6 (Nov/2020) equivalent to ISO 20595:2018
Trihalomethanes:	
Chloroform	QUI.26.IE.01, Version: 6 (Nov/2020) equivalent to ISO 20595:2018
Bromodichloromethane	QUI.26.IE.01, Version: 6 (Nov/2020) equivalent to ISO 20595:2018
Dibromochloromethane	QUI.26.IE.01, Version: 6 (Nov/2020) equivalent to ISO 20595:2018
Bromoform	QUI.26.IE.01, Version: 6 (Nov/2020) equivalent to ISO 20595:2018
Polycyclic aromatic hydrocarbons:	
Benzo(a)pyrene	QUI.94.IE.01, Version: 4 (Nov/2020) equivalent to EN 16691:2015
Benzo(b)fluoranthene	QUI.94.IE.01, Version: 4 (Nov/2020) equivalent to EN 16691:2015
Benzo(g,h,i)perylene	QUI.94.IE.01, Version: 4 (Nov/2020) equivalent to EN 16691:2015
Benzo(k)fluoranthene	QUI.94.IE.01, Version: 4 (Nov/2020) equivalent to EN 16691:2015
Indene(1,2,3-cd)pyrene	QUI.94.IE.01, Version: 4 (Nov/2020) equivalent to EN 16691:2015

Tests marked with <sup>(nac)</sup> are not included in the scope of accreditation.

<sup>(\*)</sup> The sample was not subjected to microwave digestion (turbidity value  $\leq 1.5$  NTU).

"QUI.xx.IE.xx" corresponds to the internal method of Itecons. The equivalent internal method shall be that which meets the performance characteristics and obtains results that are comparable to the standard method(s) listed therein.

SMEWW - Standard Methods for the Examination of Water and Wastewater.

**Table A2:** Measurement uncertainties corresponding to the concentration in migration water ( $c^T$ ), migration velocity ( $M^T$ ) and concentration in tap water ( $C_{tap}^T$ ) for the parameters analyzed in the migrations at 85°C and 23°C

Parameter	Expanded uncertainty at 85°C (%)			Expanded uncertainty at 23°C (%)		
	$c^T$	$M^T$	$C_{tap}^T$	$c^T$	$M^T$	$C_{tap}^T$
Odour, at 23°C <sup>(nac)</sup>	33	---	---	33	---	---
Flavour, at 23°C <sup>(nac)</sup>	33	---	---	33	---	---
Colour	17	---	---	17	---	---
Turbidity	16	---	---	16	---	---
pH	0.2 pH units	---	---	0.2 pH units	---	---
Conductivity, at 20°C	6.0	---	---	6.0	---	---
Free chlorine	23	37	37	23	37	37
Cyanides	19	29	29	19	29	29
Bromates <sup>(nac)</sup>	29	47	47	29	46	46
Fluorides <sup>(nac)</sup>	17	28	28	17	28	28
Nitrates <sup>(nac)</sup>	17	28	28	17	28	28
Chlorides <sup>(nac)</sup>	17	28	28	17	28	28
Sulphates <sup>(nac)</sup>	17	28	28	17	28	28
Ammonium <sup>(nac)</sup>	29	47	47	29	46	46
Calcium	12	19	19	12	19	19

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23/24

Parameter	Expanded uncertainty at 85°C (%)			Expanded uncertainty at 23°C (%)		
	c <sup>T</sup>	M <sup>T</sup>	Ctap <sup>T</sup>	c <sup>T</sup>	M <sup>T</sup>	Ctap <sup>T</sup>
Magnesium	13	20	20	13	20	20
Sodium	15	21	21	15	21	21
Antimony	18	24	24	18	23	23
Arsenic	17	23	23	17	22	22
Boron	13	20	20	13	20	20
Cadmium	17	23	23	17	22	22
Chromium	17	23	23	17	22	22
Copper	13	20	20	13	20	20
Lead	18	24	24	18	23	23
Mercury	22	27	27	22	26	26
Nickel	17	23	23	17	22	22
Selenium	17	23	23	17	22	22
Aluminium	12	19	19	12	19	19
Iron	15	21	21	15	21	21
Manganese	12	19	19	12	19	19
Manganese <sup>(nac)</sup>	12	19	19	12	19	19
Total organic carbon	23	28	28	23	27	27
Acrylamide <sup>(nac)</sup>	23	37	37	23	37	37
1,2-Dichlorethane	29	41	41	29	41	41
Vinyl chloride <sup>(nac)</sup>	23	37	37	23	37	37
Epichlorohydrin <sup>(nac)</sup>	23	37	37	23	37	37
Benzene	34	45	45	34	45	45
Trichloroethylene	30	42	42	30	42	42
Tetrachloroethylene	29	41	41	29	41	41
Trihalomethanes:						
Chloroform	32	43	43	32	43	43
Bromodichloromethane	30	42	42	30	42	42
Dibromochloromethane	30	42	42	30	42	42
Bromoform	32	43	43	32	43	43
Polycyclic aromatic hydrocarbons:						
Benzo(a)pyrene	23	37	37	23	37	37
Benzo(b)fluoranthene	25	39	39	25	38	38
Benzo(g,h,i)perylene	25	39	39	25	38	38
Benzo(k)fluoranthene	22	37	37	22	36	36
Indene(1,2,3-cd)pyrene	29	41	41	29	41	41

Tests marked with <sup>(nac)</sup> are not included in the scope of accreditation.

The expanded measurement uncertainty, presented in accordance with the ILAC-G17 document, is expressed by the combined standard uncertainty multiplied by the expansion factor k=2, which, for a normal distribution, corresponds to a confidence level of approximately 95%. The expanded measurement uncertainty does not include the sampling step. Uncertainties apply only to quantifiable results.