iQ-Check™ Legionella pneumophila for detection and quantification of Legionella pneumophila in all types of water

Summary report
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*Competencies of the laboratory are certified by COFRAC accreditation for the analysis marked with the symbol**

Foreword

***Studied method**:*
iQ-Check™ *Legionella pneumophila*

Validation standard
Validation protocol for commercial methods of detection and quantification of Legionella and Legionella pneumophila by concentration and gene amplification by polymerase chain reaction (PCR) V3.0

Reference method*
- NF T90-471 (June 2015): Water quality- Detection and quantification of *Legionella* and/or *Legionella pneumophila* by concentration and genic amplification by real time polymerase chain reaction (qPCR)
- ISO/TS 12869 (April 2019)**:** Water quality - Detection and quantification of *Legionella spp.* and/or *Legionella pneumophila* by concentration and genic amplification by quantitative polymerase chain reaction (qPCR)
- Validation protocol for commercial methods of detection and quantification of *Legionella* and *Legionella pneumophila* by concentration and gene amplification by polymerase chain reaction (PCR) V3.0

Scope
All types of water

Certification body
AFNOR Certification (https://nf-validation.afnor.org/en/)

1 Introduction

iQ-Check™ *Legionella* spp and iQ-Check™ *Legionella* pneumophila kits were validated in 2007. Then, they were renewed in 2011, 2015, 2019 and extended in 2012 and 2020.

In 2023, Bio-Rad wishes to extend the use of this method on their new CFX Opus 96 thermal cyclers and to demonstrate the ability to save the calibration curve generated by a batch for reuse it until the end of the batch. This extension has been realized according to the "Validation protocol for commercial methods of detection and quantification of *Legionella* and *Legionella pneumophila* by concentration and gene amplification by polymerase chain reaction (PCR) V3.0 ".

2 Review of changes in the alternative method since the previous validation

2.1 History of validation

2007:

- The method was initially validated in 2007.

2011:

- 2010/2011 study for renewal of validation considered the modifications of validated kit and of validation protocol (renewal n°1 considering norm NF T90-471 published in April 2010).
- A third-party study has focused on two first phases of validation protocol aiming to verify supplier announced performances for new formulation of iQ-Check™ *L. pneumophila* kit:
  - Phase 1: Study of limit of detection and limit of quantification of PCR step, calibrating function, link to primary standard, efficiency and robustness of extraction with Aquadien™ kit. New thermal cycler CFX 96 was implemented.
  - Phase 2: Study of inclusivity and of exclusivity, of practicability and of reagents quality.
- Interlaboratory study realized in 2007 was not made again
- New modification from initial validation was:
  - iQ-Check™ *L. pneumophila* kit: New origin of Taq polymerase and chemical evolution of IPC probe (TEXAS RED fluorophore was replaced by HEX fluorophore)
  - Aquadien Kit: two modalities of utilization according to sample filterability (protocol W2 for clogging samples added to classical protocol) and horizontal double-tangential microfiltration for DNA purification step. Membranes and materials composition do not change.

- New thermal cycler can be used: CFX96 with CFX Manager Software Industrial Diagnostic Edition version V1.1.

2012:

- ❖ Validation extension was pronounced in 2012 after evolution of characteristics of thermal cycler CFX96 which becomes CFX96 Deep Well Touch. Modifications concern reactional volume of heating block, user interface (keyboard and screen), and software CFX Manager which pass in version V1.2
- ❖ AFNOR Certification Technical Group qualified theses evolutions as minor and without impact on kit performance. No new assays were performed.

2013:

- ❖ **Late May 2013**: Validation of iQ-Check™ *L. pneumophila* method was extended to norm ISO/TS 12869. No study complement was necessary: Assays performed according to norm NF T90-471 answers to requirements of ISO/TS 12869 and follow migration to revision 2 of validation protocol.
- ❖ **November 2013:** Evolution of software CFX manager IDE v2.1. No study complement was necessary**.**

2015:

- ❖ **March 2015**: Evolution of software CFX manager IDE v2.2. No study complement was necessary.
- ❖ **October 2015**: Renewal of iQ-Check™ *L. pneumophila* method with extension on detection (qualitative research) of *Legionella pneumophila* without supplementary test. AFNOR Certification Technical Group qualified this evolution without impact on kit performance. No new assays were performed**.**

2018:

- ❖ **June 2018:** Evolution of the CFX manager iIE v3.0 software version. No further validation studies were required

2019:

- ❖ **December 2019:** Renewal of iQ-Check™ *Legionella* spp. and *Legionella pneumophila* methods. No new assays were performed.

2020:

- ❖ **December 2020:** Extension of iQ-Check™ *Legionella* spp. and *Legionella pneumophila* methods. Modifications of the protocols of DNA extraction with Aquadien™ kit. The extension of the iQ-Check™ *Legionella* only concerned the study of the yield and robustness.

2023:

- **June 2023:** Extension of iQ-Check™ *Legionella* spp. and *Legionella pneumophila* methods. Extension of the use of this method on their new CFX Opus 96 thermal cyclers. The extension of the iQ-Check™ *Legionella* only concerned a verification of the performances of the calibration function of the new thermal cycler in comparison with the previously validated thermal cycler and evolution of the "CFX Manager Industrial Diagnostic Edition" software from version V3.0 to version V3.1. All the thermal cyclers validated can be used with this version of the software. Demonstration of the ability to save the calibration curve generated by a batch for reuse it until the end of the batch

The validation history is summarized in the following table:

Method	Date of approval	Type of validation	Comments	Expert laboratory	Protocol of validation
iQ-Check™ *Legionella pneumophila*	18/12/2007	Validation		IPL SED Nord	Rev. 0 (2006)
	10/06/2011	Renewal 1	Evolution of mix PCR 2 extraction modalities (protocol W2) Update according to the version 1 protocol	IPL SED Nord	Rev. 1 (2011)
	04/04/2012	Extension 1	New thermal cycler (Deep Well touch)	Eurofins IPL Nord	Rev. 1 (2011)
	27/05/2013	Extension 2	Protocol of validation V.2	NA	Rev. 2 (2013)
	05/11/2013	Modification	Software V2.1	NA	Rev. 2 (2013)
	09/03/2015	Modification	Software V2.2	NA	Rev. 2 (2013)
	18/12/2015	Renewal 2	The modifications between the version 2.0 and 3.0 of the AFNOR validation protocol relates to the positivity threshold (quantitative detection). There was no additional study.	AdGène (with extension on qualitative test)	Rev. 3 (2015)
	June 2018		Software V3.0		
	Dec. 2019	Renewal 3	There was no additional study.	AdGène	Rev. 3 (2015)
	2020	Extension 3	Evolution of DNA extraction kit Aquadien™ protocols: short protocols & Free DNA Remove Solution protocol (FDRS protocol)	AdGène	Rev. 3 (2015)
	2023	Renewal 4 and Extension 4	New thermal cycler (CFX Opus 96) Software V3.1 – Saving of the calibration curve	Upscience	Rev. 3 (2015)

2.2 Review of changes in the alternative method

The validation protocol is identical to that of the last renewal.

Changes to the alternative method : none
This extension study is due to the releasing of the new CFX Opus 96 thermal cyclers (CFX Opus 96 and CFX Opus 96 Deep Well). The CFX Opus 96 thermal cyclers uses

the same technology as the previous CFX96 (Peltier heating block), the same software* to interpret the results, the same thermal profiles. The changes are mainly in terms of design & connectivity (Wi-Fi, Ethernet and USB; Cloud connectivity). For this extension, a verification of the performances of the calibration function of the new thermal cycler in comparison with the previously validated thermal cycler has been realized.

*Evolution of the "CFX Manager Industrial Diagnostic Edition" software from version V3.0 to version V3.1. The calculation algorithm as well as the criteria for interpreting the results remain unchanged. This new version is required for piloting actual and the new thermal cyclers.

2.3 Review of user complaints about the method

No user customer claims have been registered by AFNOR Certification.

3 Methods protocols

3.1 Principle of alternative method

iQ-Check™ Legionella *pneumophila* kit is intended to detect or to quantify bacteria genus *Legionella* species *pneumophila* in water sample, due to Polymerase Chain Reaction (PCR). PCR allows amplification and detection of specific sequences with specific primers and fluorescent probe.

Principle is based on three steps:

- Sample filtration
- DNA extraction with Aquadien™ kit (and W2 protocol for clogging samples and Free DNA Removal Solution protocol (FDRS)).
- *Legionella pneumophila* target sequences amplification.

DNA extraction with Aquadien kit is based on alkaline lysis with thermal shock. It is followed by an ultrafiltration purification step. A DNA fraction is amplified by real-time PCR (Amplification of a virulence gene (*mip*) for *L. pneumophila* and a structural gene (rRNA5S) for L. spp.).
Primers hybridize to target sequence during PCR reaction. Taq polymerase uses primers and nucleoside triphosphates (dNTPs) to stretch DNA and to create copies of *Legionella pneumophila* target DNA.

Specific probe hybridizes to amplicons during PCR. This probe is labelled with a fluorophore which emit fluorescence only after hybridization. Fluorescence intensity increases proportionally with increasing of PCR products.

Fluorescence is directly measured by optical system of the thermal cycler during hybridization step. Thermal cycler software manage in real-time the measured fluorescence function of number of amplification cycles. Software determines a Cq (cycle from which fluorescence is higher than background signal). Reading Cq permits to detect presence of *Legionella pneumophila* target sequences. Detection of target sequences indicates presence of the bacteria in water sample.

Quantification is possible by using calibrated DNA solutions iQ-Check™ *Legionella* Quantification Standards. These standards are connected to primary standard of "Centre National de Référence des Légionelles". PCR inhibition phenomenon is detected by the use of a synthetic DNA (internal control – IC) included in amplification solution with each sample. IPC is amplified during same time than target sequences, with same primers but with a different probe and a different fluorophore.

iQ-Check™® *Legionella pneumophila* kits are validated with the following materials:

Software	Opticon Monitor 3.4	CFX manager Software Industrial Diagnostic Edition V2.2	CFX manager Software Industrial Diagnostic Edition V3.0	CFX manager Software Industrial Diagnostic Edition V3.1
Thermal cyclers	Chromo4	CFX96	CFX96 CFX96 Deep Well	CFX96 CFX96 Deep Well CFX Opus 96

3.2 References of protocol

Aquadien™ (Réf. 3578121) : 12/2015 – Code : 881116
iQ-Check™*L. pneumophila* (Réf. 3578103) : 12/2015 – Code : 881117

3.3 Restrictions

The kit certification is for use with Bio-Rad Chromo™4; CFX96 DeepWell and CFX Opus 96 thermal cyclers.

3.4 Reference method*

- **NF T90-471 (June 2015):** Water quality- Detection and quantification of *Legionella* and/or *Legionella pneumophila* by concentration and genic amplification by real time polymerase chain reaction (qPCR)

- **ISO/TS 12869 (April 2019):** Water quality - Detection and quantification of *Legionella spp.* and/or *Legionella pneumophila* by concentration and genic amplification by quantitative polymerase chain reaction (qPCR)

- Validation protocol for commercial methods of detection and quantification of *Legionella* and *Legionella pneumophila* by concentration and gene amplification by polymerase chain reaction (PCR) V3.0

4 Summary of results

The results presented below were obtained with the V1.0, V2.0 and the V3.0 revisions of the validation protocol for commercial methods of detection and quantification of *Legionella* and *Legionella pneumophila* by concentration and gene amplification by polymerase chain reaction (PCR).

Results obtained for the verification of the performances of the calibration function of the CFX Opus 96 new thermal cycler in comparison with the previously validated CFX 96 thermal cycler have been included (2023).

4.1 Comparative study

4.1.1 Fitting the calibration and the reference material to the primary standard*

*These results have been obtained by the laboratory **IPL SED Nord (2011)**.*

- **Methodology**

Linking of working calibration solution to primary standard is made to cover the quantification domain with 3 ranges of calibrated DNA iQ-Check™ *Legionella pneumophila* which contain 4 levels of concentrations of Genome Unity of *Legionella pneumophila* serogroup (QS1, QS2, QS3, QS4) and 3 independent ranges of primary standard aiming at the 4 levels of concentrations of range of calibrated DNA iQ-Check™ Legionella Quantification Standards.

Linking of reference material to primary standard is evaluated analysing results of 2 deposits of reference material given with iQ-Check™ *Legionella pneumophila* kit.

- **Results**

Analysed parameters for evaluation of linking of calibration solution and of reference material to primary standard on thermal cycler CFX96 and Chromo 4 are submitted in next table:

	Regression curve	Correlation	Efficiency (%)
Reference range (CFX96)	C(t) average = -3,429.log(x) + 39,891	0,998	95,7
Reference range (Chromo 4)	C(t) average = -3,330.log(x) + 39,229	0,993	99,7

Calibration solution	Calibration error			
	QS1	QS2	QS3	QS4
Per level (CFX96)	0,03	0,12	0,12	0,10
Per level (Chromo 4)	-0,05	0,00	0,00	0,06
Average (CFX96)	0,09			
Average (Chromo 4)	0,00			
Slopes equivalence (CFX96)	0,07			
Slopes equivalence (Chromo 4)	0,11			

Reference material	Calibration error
CFX96	0,09
Chromo 4	0,16

The raw data are presented in appendix 1.

- **Conclusion**

Calibration solution and reference material of iQ-Check™ *Legionella pneumophila* kit satisfy conditions of linking to primary standard with thermal cycler CFX96.

Calibration solution satisfies conditions of linking to primary standard with thermal cycler Chromo 4. Reference material of iQ-Check™ *Legionella pneumophila* kit satisfies conditions of linking to primary standard with thermal cycler Chromo 4.

4.1.2 Study of the calibration function of the quantitative PCR step*

*These results have been obtained by the laboratory **IPL SED Nord (2011)** and by the laboratory **Upscience (2023).***

- **Methodology**

Study of calibration function is made deposit 5 different reference ranges of calibrated DNA solution iQ-Check™ *Legionella* Quantification Standards (comprising 4 levels of concentration of Genome Unity of *Legionella pneumophila*), given with iQ-Check™ *Legionella pneumophila* kit.

5 measures are made with iQ-Check™ *Legionella pneumophila* kit for each level of concentration in reproducibility conditions.

- **Results**

Equation of regression curve and efficiency of PCR reaction are defined in these conditions. Results are obtained on **CFX96**.

Regression curve	-3,618.log(x) + 42,447
Efficiency	89,0 %
r^2	0,999

	QS1	QS2	QS3	QS4
Bias	0,00	-0,02	0,02	-0,01
Standard deviation	0,15	0,03	0,04	0,07
Exactitude of linearity	0,15	0,03	0,05	0,07
Uncertainty of linearity	0,47	0,10	0,15	0,22

The raw data are presented in appendix 2.

- **Results *obtained by the laboratory Upscience (2023)***

Results of the comparison obtained on **CFX96** and **CFX Opus 96 :**

CFX96				
	QS1	QS2	QS3	QS4
Bias	0,08	0,09	0,07	0,09
Standard deviation	0,05	0,01	0,06	0,01
Exactitude of linearity	0,09	0,09	0,10	0,09
uncertainty of linearity	0,26	0,26	0,27	0,24

Regression curve	-3,259.log(x) + 39,42
Efficiency	102,7%
r^2	0,995

CFX Opus 96				
	QS1	QS2	QS3	QS4

Bias	0,04	0,04	0,06	0,06
Standard deviation	0,11	0,04	0,01	0,07
Exactitude of linearity	0,12	0,06	0,06	0,09
uncertainty of linearity	0,32	0,16	0,18	0,25

Regression curve	-3,286.log(x) + 39,386
Efficiency	101,5%
r^2	0,998

The raw data are presented in Appendix 2.

- **Conclusion**

Linear regression satisfies exigence of exactitude lower than 0.15log for each level of reference range both the CFX 96 and CFX Opus 96 thermal cyclers. Linearity is verified on the whole domain cover by the range of calibrated DNA solution iQ-Check™ *Legionella* Quantification Standards given with iQ-Check™ *Legionella pneumophila*. kit.

- **Complementary study – Save of the calibration curve**

In 2023, Bio-Rad wishes to demonstrate the ability to save the calibration curve generated by a batch for reuse it until the end of the batch. For that, calibration curve is analysed with the 4 levels of concentration (QS1; QS2; QS3; QS4) before to save this generated curve. Then, the QS2 point was analysed over several weeks to verify conformity.

Calibration curve				
Nom	QS1	QS2	QS3	QS4
Copy number (log)	1,28	2,59	3,59	4,59
CFX 96	35,24	31,36	28,07	24,22
	35,05	31,25	28,07	24,19
CFX Opus 96	35,70	30,90	27,33	24,07
	35,55	30,72	27,38	24,12

CFX 96					
QS2 =		390 copies (Log : 2,59)			
Date	Point	CT	Copy number	Log copy number	Deviation theoretical value (Log)
15/05/2023	QS2	30,34	611	2,79	0.20
		30,69	477	2,68	0.09
23/05/2023	QS2	30,41	582	2,76	0.17

		31,04	373	2,57	-0.02
26/05/2023	QS2	31,08	362	2,56	-0.03
		30,53	534	2,73	0.14
30/05/2023	QS2	31,02	378	2,58	-0.01
		30,8	442	2,64	0.05

CFX OPUS 96					
QS2 =		390 copies (Log : 2,59)			
Date	Point	CT	Copy number	Log copy number	Deviation theoretical value(Log)
15/05/2023	QS2	30,75	425	2,63	0.04
		30,59	475	2,68	0.09
23/05/2023	QS2	30,74	428	2,63	0.04
		30,82	404	2,61	0.02
26/05/2023	QS2	30,91	380	2,58	-0.01
		30,72	434	2,64	0.05
30/05/2023	QS2	30,74	428	2,63	0.04
		30,55	488	2,69	0.10

The calculated quantity of the QS is within ±0.3 log of the theorical value. The results of the save of the calibration curve are satisfactory.

4.1.3 Limit of detection*

*These results have been obtained by the laboratory **IPL SED Nord (2011)**.*

- **Methodology**

Evaluation of limit of detection is made from 30 independent dilutions of *Legionella pneumophila* DNA in concentration of 5 GU per PCR reaction. Duplicate amplifications are made in repeatability conditions. Results are obtained on CFX96.

- **Results**

Echantillons à la concentration 5UG

Sample	C(t)	I.C. C(t)	SQ
e1	N/A	32,04	N/A
	38,81	32,02	3,68
e2	39,05	32,08	3,11
	38,83	31,98	3,63
e3	37,98	31,86	6,66
	39,52	31,72	2,23
e4	38,57	31,87	4,38
	39,44	31,77	2,35
e5	42,73	32,05	0,23
	40,3	32,03	1,28
e6	39,9	31,93	1,71
	39,65	31,99	2,03
e7	38,37	31,81	5,04
	39,73	31,88	1,92
e8	39,28	32,05	2,65
	39,02	31,89	3,18
e9	38,69	32,09	4,01
	39,19	31,98	2,81
e10	40,62	31,79	1,02
	39,18	31,92	2,84
e11	39,56	31,89	2,17
	38,09	31,86	6,15
e12	39,1	32,01	3,01
	39,2	31,6	2,79
e13	40,67	31,77	0,98
	39,55	32,02	2,19
e14	39,01	31,96	3,20
	40,25	31,68	1,33
e15	38,17	31,71	5,81
	38,93	31,68	3,40
e16	39,69	31,67	1,97
	41,36	31,64	0,61
e17	38,62	31,95	4,22
	41,32	31,86	0,62
e18	38,65	32,04	4,14
	38,54	31,99	4,45
e19	39,27	31,55	2,67
	38,13	31,71	5,98
e20	39,24	31,85	2,72
	39,47	32,02	2,31
e21	38,12	32,17	6,03
	39,76	31,93	1,88
e22	40,31	32,02	1,27
	40,17	31,89	1,41
e23	39,48	31,93	2,30
	40,21	31,77	1,37
e24	41,17	31,97	0,69
	39,48	32,18	2,29
e25	39,95	32,23	1,65
	40,02	32,15	1,56
e26	39,93	31,74	1,67
	42,08	32,62	0,36
e27	41,1	31,93	0,73
	42,21	32	0,33
e28	40,01	32,2	1,57
	41,14	32,01	0,71
e29	N/A	32	N/A
	38,17	32,07	5,82
e30	37,35	31,95	10,36
	38,08	31,97	6,19

All results are presented in appendix 3.

- **Conclusion**

The 30 duplicates are positives excepted for e1 and e29 where only one repetition have given a positive result. Limit of detection is validated for 5 GU per PCR reaction.
The majority of Ct in previous table are lower than intercept and the rare values above do not impact the compliance of the detection limit at 5 UG per PCR. Qualitative detection is conforming.

4.1.4 Limit of quantification*

*These results have been obtained by the laboratory **IPL SED Nord (2011)**.*

- **Methodology**

Evaluation of limit of quantification is made from 30 independent dilutions of *Legionella pneumophila* DNA in concentration of 15 GU per PCR reaction. Duplicate amplifications are made in repeatability conditions. Results are obtained on **CFX96**.

- **Results**

	Results	Theoretical values or validation criteria
Average x' (Log GU/well)	1,337	1,279
Standard deviation (Log GU/well)	0,102	
Bias	0,059	
LQ Exactitude	0,117	0,15
LQ Uncertainty	0,240	

All results are presented in appendix 4.

- **Conclusion**

Value of exactitude of limit of quantification is estimated at 0.101. This value is lower than 0.15. Limit of quantification is validated for 15 GU per PCR reaction for iQ-Check™ *Legionella pneumophila* kit.

4.1.5 Positivity threshold

*These results have been obtained by the laboratory **IPL SED Nord (2011)**.*

User manual foresees a Cq of 43 hereafter whose samples are considered as lower than the limit of detection
All values for characterization of limit of detection have Cq lower than 43. This value corresponds to the positivity threshold lower than limit of detection.

4.1.6 Study of the yield and robustness*

*Results for Aquadien™ and Aquadien W2 (for clogging waters) protocols have been obtained by the laboratory **IPL SED Nord** in **2011**. Results for Aquadien™; Aquadien W2; and FDRS short protocols have been obtained in **2020** by the laboratory **AdGène**.*

- **Methodology**

Studies of extraction efficiency were realized with extraction kit Aquadien™ in classical and short protocols. Efficiency was evaluated on 10 independent samples, which were artificially contaminated with two levels of concentrations of *Legionella pneumophila* ATCC 33152 (1000 and 100 000 GU/ PCR reaction). Samples were 3 different matrices: sterile water, domestic hot water and water from air cooling-tower.

Samples were artificially contaminated by primary bacterial suspension. Its concentration was determined by 3 quantifications after an extraction step of DNA by direct lysis on 3 aliquots. Results are obtained on **CFX96**.

- **Results**

		YIELD			
		Aquadien Protocol		Aquadien Protocol W2	
		Log	Average	Log	Average
Domestic hot water	1000 GU/L 100 000 GU/L	-0,41 -0,40	-0,41	-0,47 -0,56	-0,51
Water from cooling-tower	1000 GU/L 100 000 GU/L	-0,17 -0,51	-0,34	-0,47 -0,51	-0,49
Mineral water	1000 GU/L 100 000 GU/L	-0,18 -0,38	-0,28	-0,47 -0,44	-0,45
Average yield (log)		-0,34		-0,49	
Variance (log)		0,03		0,01	
Global extended uncertainty (log)		0,77		0,98	

		YIELD					
		Aquadien Short Protocol		Aquadien W2 Short Protocol		Aquadien FDRS Short Protocol	
		Log	Average	Log	Average	Log	Average
Domestic hot water	1000 GU/L 100 000 GU/L	-0.35 -0.27	-0.31	-0.23 -0.27	-0.25	-0.23 -0.27	-0.25
Water from cooling-tower	1000 GU/L 100 000 GU/L	-0.32 -0.33	-0.33	-0.25 -0.31	-0.28	-0.31 -0.34	-0.32
Mineral water	1000 GU/L 100 000 GU/L	-0.35 -0.33	-0.34	-0.30 -0.27	-0.29	-0.30 -0.36	-0.33
Average yield (log)		-0.33		-0.27		-0.3	
Variance (log)		0.01		0.01		0.02	
Global extended uncertainty (log)		0.68		0.59		0.65	

Raw data are presented in appendix 5.

- **Conclusion**

Study of efficiency and robustness of extraction method allows evaluating average efficiency of:

- Aquadien method: -0,34 log
- Aquadien W2 method: -0,49 log
- Aquadien short method: -0,33 log
- Aquadien W2 short method: -0,27 log
- Aquadien FDRS short method: -0,3 log

Efficiencies with five extraction methods are conforming to criteria -0,6 log / +0,3 log (equivalent to efficiency comprise between 25% and 199%).

4.1.7 Selectivity: inclusivity and exclusivity*

*Results have been obtained by the laboratory **IPL SED Nord (2011)**.*

DNA was extracted from pure bacterial suspension for each strain.

- **Inclusivity**

Inclusivity assays were realized on DNA extracts with concentration about 100 GU per PCR reaction. Concentrations were estimated by O.D.600nm of bacterial suspension.

DNA of 15 *Legionella pneumophila* were amplified.

All results are presented in appendix 6.

- **Exclusivity**

Exclusivity assays were realized on DNA extracts with concentration about 10 000 GU per PCR reaction. Concentrations were estimated by O.D.600nm of bacterial suspension.

DNA of 16 strains non-Legionella 9 strains non-Legionella *pneumophila* tested were not amplified.

All results are presented in appendix 6.

- **Conclusion**

The selectivity of the iQ-Check kit™ *Legionella pneumophila* is consistent.

4.1.8 Practicability

Protocol	R1 solution	W2 solution	FDRS solution	R2 solution	Time
Aquadien	2 mL	-	-	100 µL	1h10
Aquadien short	1 mL	-	-	100 µL	40 min
Aquadien W2	2 mL	200 µL	-	350 µL	1h10
Aquadien W2 short	1 mL	100 µL	-	225µL	1h10
Aquadien FDRS short	500 µL	-	40µL	100 µL	1h10

- **Ease of use**: reagents are all supplied with kits and are ready-to-use. Serial analyses from 1 to 30 samples, for quantification, are easy to make. A technician, who knows microbiology and molecular biology techniques and the specific thermal cycler and its software, can be trained in 1 day.

- **Fast results report**: duration of different phases is compatible with a short results report (5 hours).

- **Results security**: It guarantees by utilization of inhibition internal control (in same reaction well than sample) and by a software of results analysis. Use of software ensures traceability of complete information.

4.2 Inter-laboratory study

4.2.1 Methodology

Inter-laboratories study was realized in 2007 with 14 collaborating laboratories. Results of one laboratory were not taken into account because of technical problem which invalidated standardization. 13 laboratories were retained for statistical exploitation.
Goal of this study is to evaluate fidelity (repeatability and reproducibility) of iQ Check™ *Legionella pneumophila* method:

- For only amplification step (2 DNA solutions of *L. anisa* et *L. pneumophila* sg1 at 2 different levels of concentration).
- For complete analysis (concentration, lysis, extraction, purification and gene amplification) on characterized bacterial suspensions of *L. pneumophila* and *Escherichia coli* (CIP 54.8) at 2 different levels of concentration).
- For whole analysis in real situation (hot domestic water naturally contaminated by *L. pneumophila* and *Legionella* spp.).
- For a water guarantees without any DNA of *Legionella*.

4.2.2 Results

	Type of samples	Calibrated DNA solution		Spiked Tap water		water Natural sample
Spiking levels (GU/L)	*L. pneumophila* ATCC 33152	2000 GU/µl	20000 GU/µl	4000 GU/200 ml	40000 GU/200 ml	hot water naturally contaminated
	L. anisa	500 GU/µl	5000 GU/µl	1000 GU/200 ml	10000 GU/200 ml	
	E. coli			5000 GU/200 ml	50000 GU/200 ml	
Number of laboratories	Participant	14	14	14	14	14
	Retained	13	13	13	13	13
Homogeneity Test	Number of analyses	20	20	9	9	9
	Average (Log)	2.91	3.97	3.42	4.41	3.76
Results	Average (Log)	2.93	3.96	3.40	4.44	3.18
	r (Log)	0.18	0.08	0.23	0.20	0.62
	R (Log)	0.20	0.15	0.96	0.84	0.87
	Sr (Log)	0.06	0.03	0.1	0.07	0.22
	SR (Log)	0.04	0.05	0.24	0.29	0.21

4.2.3 Conclusion

Repeatability values in r (log) are about 0.1 for DNA solutions (only PCR step) and about 0.2 – 0.6 for bacterial suspensions (global method). This is acceptable. Signification of these results is that we can wait for factor 2.5 measurement of deviation in a same laboratory. Repeatability is not a major source of error.
Reproducibility values in R (log) are about 0.2 for DNA solutions (only PCR step) and about 0.9 for bacterial suspensions (global method). Compared to repeatability, this order of magnitude is equivalent to values that we can obtain for environmental microbiology analyses. Signification of these results is that we can wait for factor 8 of measurement deviation between 2 different laboratories. Reproducibility does not participate in an unreasonable way to result dispersion.

5 General conclusions

Performances of iQ-Check™ *Legionella pneumophila* method are conforming to requirement of norms NF T90-471 and ISO/TS 12869, and of AFNOR validation protocol: "Validation protocol for commercial methods of detection and quantification of *Legionella* and *Legionella pneumophila* by concentration and gene amplification by polymerase chain reaction (PCR) V3.0".

The evolution of the "CFX Manager Industrial Diagnostic Edition" software from version V3.0 to version V3.1 required for piloting actual and the new thermal cyclers, does not affect the results given that the calculation algorithm as well as the criteria for interpreting the results remain unchanged.

iQ-Check™ Legionella *pneumophila* kit is a kit validated for **detection and quantification** of *Legionella* and/or *Legionella pneumophila* by concentration and gene amplification by real-time Polymerase Chain Reaction (qPCR).

Done at Thury-Harcourt, July 3, 2023
Mickaël MORVAN
Research & Development Engineer

6 Bibliography

Six studies have been published since 2008:

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- Ditommaso, S., M.,Elisa Ricciardi , S., Giacomuzzi, R. Arauco Rivera , S., M. Zotti, C., **2015**. ***Legionella*** in water samples: How can you interpret the results obtained by quantitative PCR? *Molecular and Cellular Probes*. 29:7–12.

- Ditommaso, S., Giacomuzzi, M.,Elisa Ricciardi, M. Zotti, C., **2016**. Cultural and Molecular Evidence of ***Legionella*** spp. Colonization in Dental Unit Waterlines: Which Is the Best Method for Risk Assessment? *International Journal of Environmental Research and Public Health*. 13(2): 211

- Montagna, M. T., De Giglio, O., Cristina, M.L., Napoli, C., Pacifico, C., Agodi., A., Baldovin, T., Casini, B., Coniglio., M. A., Mario D'Errico, M., Delia, S. A., Deriu, M. G., Guida, M., Laganà, P., Liguori, G., Moro, M., Mura, I., Pennino, F., Privitera, G., Spica, V.R., Sembeni, S., Spagnolo, A.M., Tardivo, S., Torre, I., Valeriani, F., Albertini, R., Pasquarella, C., **2017**. Evaluation of ***Legionella*** Air Contamination in Healthcare Facilities by Different Sampling Methods: An Italian Multicenter Study. *International Journal of Environmental Research and Public Health.* 14(7): 670

- Bonetta, S., Pignata, C., Bonetta, S., Meucci, L., Giacosa, D., Marino, E., Gilli, G., Carraro, E., **2017**. Viability of ***Legionella*** *pneumophila* in Water Samples: A Comparison of Propidium Monoazide (PMA) Treatment on Membrane Filters and in Liquid. *International Journal of Environmental Research and Public Health.* 14(5), 467

- Bayle, S., Martinez-Arribas, B., Jarraud, S., Giannoni, P., Garrelly, L., Roig, B., Cadière, A., **2020**. Development of a DGGE method to explore ***Legionella*** communities. *Heliyon*, 6(1).

In six articles, iQ-Check *Legionella* methods were used with satisfaction.

There have been no external validations by another certification body

Appendix 1: Fitting to the primary standard

Results from iQ-Check™ Quanti L. pneumophila – Extension 2011 - v01 achieved by IPL santé, environnement durables Nord

Raccordement sur CFX96

Gamme de référence

Niveaux testés	(UG/puits)	15	420	4200	42000
	log (UG/Puits)	1,17609	2,62325	3,62325	4,62325
C(t) obtenus	Gamme étalon 1	35,63	31,05	27,39	24,10
		35,90	31,23	27,35	24,02
	Gamme étalon 2	35,26	30,96	27,48	24,07
		36,33	30,87	27,71	23,88
	Gamme étalon 3	35,61	31,09	27,35	24,10
		36,01	31,01	27,28	23,89

Pente	-3,429
Ordonnée à l'origine	39,891
Corrélation (r^2)	0,998
Efficacité (%)	95,727

Raccordement de la solution calibrante

Solution calibrante

Niveaux estimé	(UG/puits)	19	390	3900	39000
	log (UG/Puits)	1,27875	2,59106	3,59106	4,59106
C(t) obtenus	Gamme calib 1	35,66	31,48	28,10	24,45
		35,35	31,49	27,93	24,57
	Gamme calib 2	35,81	31,65	27,82	24,48
		35,65	31,24	28,02	24,48
	Gamme calib 3	35,92	31,49	28,00	24,51
		35,22	31,22	28,00	24,42
C(t) moyen par niveau		35,60	31,43	27,98	24,49
Quantité retrouvée par niveau (Lo		1,25	2,47	3,47	4,49
Erreur de calibr par niveau		0,03	0,12	0,12	0,10
	moyenne		0,09		
Vérification de l'équivalence des			0,07		

Raccordement du matériau de référence

Matériau de référence

Valeur de référ	(UG/puits)	540
	log (UG/Puits)	2,73239
C(t) obtenus	MR1	30,84
	MR2	30,80

C(t) moyen	30,82
Quantité retrouvée par niveau (Log)	2,65
Erreur de calibrage	0,09

Raccordement sur Chromo 4

Gamme de référence

Niveaux testés	(UG/puits)	15	420	4200	42000
	log (UG/Puits)	1,17609	2,62325	3,62325	4,62325
C(t) obtenus	Gamme étalon 1	34,98	30,54	27,19	23,94
		35,06	30,83	26,71	23,76
	Gamme étalon 2	35,04	30,97	27,35	23,95
		36,5	30,17	27,23	23,61
	Gamme étalon 3	35	30,46	26,61	24,01
		35	30,78	27,37	23,79

Pente	-3,330
Ordonnée à l'origine	39,229
Corrélation (r^2)	0,993
Efficacité (%)	99,677

Raccordement de la solution calibrante

Solution calibrante

Niveaux estimé	(UG/puits)	19	390	3900	39000
	log (UG/Puits)	1,27875	2,59106	3,59106	4,59106
C(t) obtenus	Gamme calib 1	34,49	30,59	27,30	24,17
		35,61	31,00	27,66	24,43
	Gamme calib 2	34,55	30,42	27,19	24,48
		34,89	30,63	27,40	23,93
	Gamme calib 3	34,96	30,58	26,99	23,98
		34,36	30,41	27,13	23,93
C(t) moyen par niveau		34,81	30,61	27,28	24,15
Quantité retrouvée par niveau (Lo		1,33	2,59	3,59	4,53
Erreur de calibr par niveau		-0,05	0,00	0,00	0,06
	moyenne		0,00		
Vérification de l'équivalence des			0,11		

Raccordement du matériau de référence

Matériau de référence

Valeur de référ	(UG/puits)	540
	log (UG/Puits)	2,73239
C(t) obtenus	MR1	30,74
	MR2	30,57

C(t) moyen	30,66
Quantité retrouvée par niveau (Log)	2,58
Erreur de calibrage	0,16

Appendix 2: Calibration function

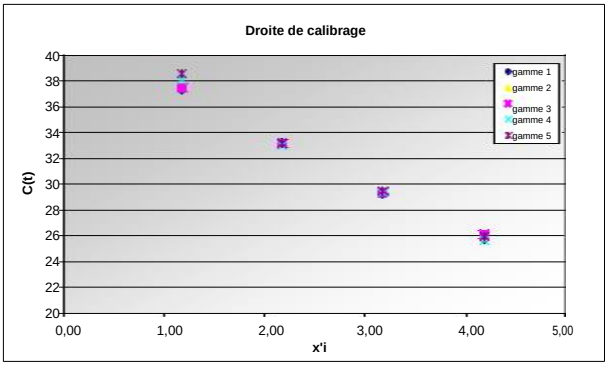
Niveau (UG/puits)	x_i	19	390	3900	39000	19	390	3900	39000
	$x'_j = \text{Log}(x_j)$	1,28	2,59	3,59	4,59	1,28	2,59	3,59	4,59
gamme	gamme 1	37,60	33,28	29,21	26,01				
y_{ij}		37,08	33,15	29,30	25,40	37,34	33,22	29,26	25,71
	gamme 2	37,47	33,21	29,33	25,99				
k=5 répétitions		37,61	33,05	29,42	25,85	37,54	33,13	29,38	25,92
	gamme 3	37,65	33,11	29,44	26,06				
		37,34	33,22	29,31	26,15	37,50	33,17	29,38	26,11
	gamme 4	38,39	33,01	29,26	25,71				
		37,77	33,00	29,45	25,54	38,08	33,01	29,36	25,63
	gamme 5	38,58	33,23	29,30	26,02				
		38,60	33,06	29,72	25,97	38,59	33,15	29,51	26,00
Moyenne	m_i	37,81	33,13	29,37	25,87	37,81	33,13	29,37	25,87

Estimation de la droite de régression

Pente	a =	-3,618
Ordonnée à l'origine	b =	42,447

Estimation de l'efficacité

Efficacité	e =	89,0%



Vérification des performances de la régression linéaire

Niveau	x_i	19	390	3900	39000	19	390	3900	39000
	$x'_j = \text{Log}(x_j)$	1,28	2,59	3,59	4,59	1,28	2,59	3,59	4,59
gamme	gamme 1	1,34	2,53	3,66	4,54				
y_{ij}		1,48	2,57	3,63	4,71	1,41	2,55	3,65	4,63
	gamme 2	1,38	2,55	3,63	4,55				
k=5 répétitions		1,34	2,60	3,60	4,59	1,36	2,58	3,61	4,57
	gamme 3	1,33	2,58	3,60	4,53				
		1,41	2,55	3,63	4,50	1,37	2,57	3,61	4,52
	gamme 4	1,12	2,61	3,64	4,63				
		1,29	2,61	3,59	4,67	1,21	2,61	3,62	4,65
	gamme 5	1,07	2,55	3,63	4,54				
		1,06	2,59	3,52	4,55	1,07	2,57	3,58	4,55
Moyenne	m_i	1,28	2,57	3,61	4,58	1,28	2,57	3,61	4,58

Biais		0,00	-0,02	0,02	-0,01
Ecart type	S =	0,15	0,03	0,04	0,07
Exactitude de linéarité	E_{LIN} =	0,15	0,03	0,05	0,07
Incertitude de linéarité	U_{LIN} =	0,47	0,10	0,15	0,22

Niveau (UG/puits)	x_i	19	390	3900	39000
	$x'_i = \text{Log}(x_i)$	1,28	2,59	3,59	4,59

19	390	3900	39000
1,28	2,59	3,59	4,59

gamme y_{ij} k = 5 répétitions					
	Gamme 1	35,24	31,36	28,07	24,22
		35,05	31,25	28,07	24,19
	Gamme 2	35,67	31,27	28,03	24,17
		34,71	31,19	27,97	24,14
	Gamme 3	34,68	31,36	27,93	24,18
		34,91	31,26	27,23	24,23
	Gamme 4	34,97	31,29	28,02	24,05
		34,91	31,34	28,01	24,22
	Gamme 5	34,38	31,21	28,03	24,08
		35,47	31,27	28,12	24,26

35,15	31,31	28,07	24,21
35,19	31,23	28,00	24,16
34,79	31,31	27,58	24,21
34,94	31,31	28,01	24,13
34,92	31,24	28,08	24,17

Moyenne	m_i	35,00	31,28	27,95	24,17

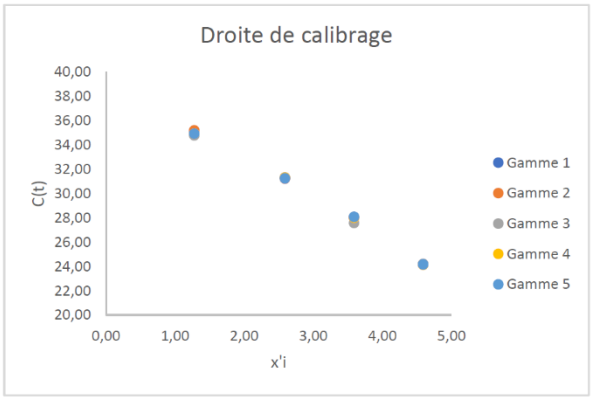
35,00	31,28	27,95	24,17

Estimation de la droite de régression

Pente	a =	-3,259
Ordonnée à l'origine	b=	39,42

Estimation de l'efficacité

Efficacité	e =	102,7



Vérification des performances de la régression linéaire

Niveau (UG/puits)	x_i	19	390	3900	39000
	$x'_i = \text{Log}(x_i)$	1,28	2,59	3,59	4,59

19	390	3900	39000
1,28	2,59	3,59	4,59

gamme y_{ij} k = 5 répétitions					
	Gamme 1	1,28	2,47	3,48	4,66
		1,34	2,51	3,48	4,67
	Gamme 2	1,15	2,50	3,50	4,68
		1,45	2,52	3,51	4,69
	Gamme 3	1,45	2,47	3,53	4,68
		1,38	2,50	3,74	4,66
	Gamme 4	1,37	2,49	3,50	4,71
		1,39	2,48	3,50	4,67
	Gamme 5	1,55	2,52	3,49	4,71
		1,21	2,50	3,47	4,65

1,31	2,49	3,48	4,67
1,30	2,51	3,50	4,68
1,42	2,49	3,63	4,67
1,38	2,49	3,50	4,69
1,38	2,51	3,48	4,68

Moyenne	m_i	1,36	2,50	3,52	4,68

1,36	2,50	3,52	4,68

Biais	0,08	0,09	0,07	0,09
Ecart type S =	0,05	0,01	0,06	0,01
Exactitude de linéarité E_{LIN}	0,09	0,09	0,10	0,09
Incertitude de linéarité U_{LIN}	0,26	0,26	0,27	0,24

Niveau (UG/puits)	x_i	19	390	3900	39000
	$x'_i = \text{Log}(x_i)$	1,28	2,59	3,59	4,59

gamme y_{ij} k = 5 répétitions					
	Gamme 1	35,70	30,90	27,33	24,07
		35,55	30,72	27,38	24,12
	Gamme 2	34,76	30,49	27,34	24,43
		35,12	30,57	27,34	24,61
	Gamme 3	35,97	30,82	27,36	24,67
		35,56	30,93	27,48	24,58
	Gamme 4	34,85	30,80	27,41	24,64
		35,35	30,91	27,30	24,65
	Gamme 5	35,16	30,67	27,42	24,60
		35,21	30,64	27,42	24,55
Moyenne	m_i	35,32	30,75	27,38	24,49

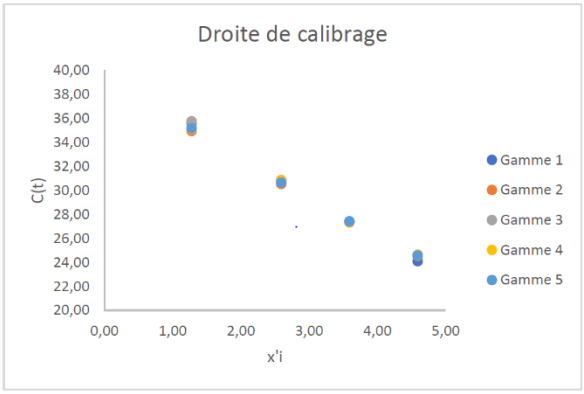
19	390	3900	39000
1,28	2,59	3,59	4,59
35,62	30,81	27,36	24,10
34,94	30,53	27,34	24,52
35,76	30,88	27,42	24,63
35,10	30,85	27,36	24,64
35,19	30,66	27,42	24,58
35,32	30,75	27,38	24,49

Estimation de la droite de régression

Pente	a =	-3,2862
Ordonnée à l'origine	b=	39,386

Estimation de l'efficacité

Efficacité	e =	101,5



Vérification des performances de la régression linéaire

Niveau (UG/puits)	x_i	19	390	3900	39000
	$x'_i = \text{Log}(x_i)$	1,28	2,59	3,59	4,59

gamme y_{ij} k = 5 répétitions					
	Gamme 1	1,12	2,58	3,67	4,66
		1,17	2,64	3,65	4,64
	Gamme 2	1,41	2,71	3,66	4,55
		1,30	2,68	3,67	4,50
	Gamme 3	1,04	2,61	3,66	4,48
		1,17	2,57	3,62	4,50
	Gamme 4	1,38	2,61	3,64	4,49
		1,23	2,58	3,68	4,48
	Gamme 5	1,29	2,65	3,64	4,50
		1,27	2,66	3,64	4,51
Moyenne	m_i	1,24	2,63	3,65	4,53

19	390	3900	39000
1,28	2,59	3,59	4,59
1,15	2,61	3,66	4,65
1,35	2,69	3,67	4,52
1,10	2,59	3,64	4,49
1,30	2,60	3,66	4,49
1,28	2,66	3,64	4,51
1,24	2,63	3,65	4,53

Biais	0,04	0,04	0,06	0,06
Ecart type S =	0,11	0,04	0,01	0,07
Exactitude de linéarité E_{LIN}	0,12	0,06	0,06	0,09
Incertitude de linéarité U_{LIN}	0,32	0,16	0,18	0,25

Appendix 3: Limit of detection

Results from iQ-Check™ Quanti L. pneumophila – Extension 2011 - v01 achieved by IPL santé, environnement durables Nord

Echantillons à la concentration 5UG

Sample	C(t)	I.C. C(t)	SQ
e1	N/A	32,04	N/A
	38,81	32,02	3,68
e2	39,05	32,08	3,11
	38,83	31,98	3,63
e3	37,98	31,86	6,66
	39,52	31,72	2,23
e4	38,57	31,87	4,38
	39,44	31,77	2,35
e5	42,73	32,05	0,23
	40,3	32,03	1,28
e6	39,9	31,93	1,71
	39,65	31,99	2,03
e7	38,37	31,81	5,04
	39,73	31,88	1,92
e8	39,28	32,05	2,65
	39,02	31,89	3,18
e9	38,69	32,09	4,01
	39,19	31,98	2,81
e10	40,62	31,79	1,02
	39,18	31,92	2,84
e11	39,56	31,89	2,17
	38,09	31,86	6,15
e12	39,1	32,01	3,01
	39,2	31,6	2,79
e13	40,67	31,77	0,98
	39,55	32,02	2,19
e14	39,01	31,96	3,20
	40,25	31,68	1,33
e15	38,17	31,71	5,81
	38,93	31,68	3,40
e16	39,69	31,67	1,97
	41,36	31,64	0,61
e17	38,62	31,95	4,22
	41,32	31,86	0,62
e18	38,65	32,04	4,14
	38,54	31,99	4,45
e19	39,27	31,55	2,67
	38,13	31,71	5,98
e20	39,24	31,85	2,72
	39,47	32,02	2,31
e21	38,12	32,17	6,03
	39,76	31,93	1,88
e22	40,31	32,02	1,27
	40,17	31,89	1,41
e23	39,48	31,93	2,30
	40,21	31,77	1,37
e24	41,17	31,97	0,69
	39,48	32,18	2,29
e25	39,95	32,23	1,65
	40,02	32,15	1,56
e26	39,93	31,74	1,67
	42,08	32,62	0,36
e27	41,1	31,93	0,73
	42,21	32	0,33
e28	40,01	32,2	1,57
	41,14	32,01	0,71
e29	N/A	32	N/A
	38,17	32,07	5,82
e30	37,35	31,95	10,36
	38,08	31,97	6,19

Contrôle Gamme Standard

Content	C(t)	I.C. C(t)	SQ
QS1	36,21	31,82	19,00
QS1	36,42	31,93	19,00
QS2	32,65	32,13	390,00
QS2	32,35	31,98	390,00
QS3	28,99	31,86	3900,00
QS3	29,14	32,11	3900,00
QS4	25,53	32,64	39000,00
QS4	25,64	32,9	39000,00

Contrôle négatif

Content	C(t)	I.C. C(t)	SQ
Neg Ctrl	N/A	32,17	N/A
Neg Ctrl	N/A	32,08	N/A

Appendix 4: Limit of quantification

Results from iQ-Check™ Quanti L. pneumophila – Extension 2011 - v01 achieved by IPL santé, environnement durables Nord

LQ à 15UG

Gamme de calibrage QS

	UG/puits	Moy Log (UG/puits)	C(t)
QS1		1,278753601	38,05
	19	1,278753601	38,52
QS2		2,591064607	33,2
	390	2,591064607	33,46
QS3		3,591064607	30,68
	3900	3,591064607	29,87
QS4		4,591064607	26,88
	39000	4,591064607	26,62

Pente	-3,451
Ordonnée origine	42,559
Corrélation (r^2)	0,995
Efficacité (%)	94,869

LQ_{PCR} à 15UG : 30 mesures en réplicat

	C(t)		UG/puits			
	Réplicat	Moyenne	UG/puits	Moy UG/puits	*x'* (Log)	Moyenne *x'*
LQ-1	37,93		21,9		1,341	
	37,94	37,94	21,7	21,8	1,338	1,340
LQ-2	37,94		21,8		1,338	
	38,31	38,12	17,0	19,4	1,231	1,285
LQ-3	37,82		23,6		1,373	
	39,09	38,45	10,1	16,9	1,005	1,189
LQ-4	38,05		20,3		1,306	
	38	38,02	21,0	20,6	1,321	1,314
LQ-5	38,82		12,1		1,083	
	36,73	37,77	48,8	30,5	1,689	1,386
LQ-6	38,2		18,3		1,263	
	37,96	38,08	21,5	19,9	1,332	1,298
LQ-7	37,67		26,1		1,417	
	37,27	37,47	34,1	30,1	1,532	1,474
LQ-8	36,48		57,5		1,761	
	37,48	36,98	29,6	43,5	1,472	1,616
LQ-9	38,28		17,3		1,240	
	37,76	38,02	24,6	21,0	1,390	1,315
LQ-10	38,12		19,3		1,286	
	37,64	37,88	26,6	22,9	1,425	1,356
LQ-11	37,45		30,1		1,480	
	39,25	38,35	9,1	19,6	0,959	1,219
LQ-12	37,7		25,5		1,408	
	37,91	37,8	22,3	23,9	1,347	1,377
LQ-13	37,42		30,8		1,489	
	37,58	37,5	27,6	29,2	1,443	1,466
LQ-14	38,08		19,8		1,298	
	37,64	37,86	26,6	23,2	1,425	1,361
LQ-15	38,32		16,9		1,228	
	37,34	37,83	32,5	24,7	1,512	1,370
LQ-16	38,02		20,6		1,315	
	38,32	38,17	16,9	18,8	1,228	1,272
LQ-17	38,73		12,8		1,109	
	36,7	37,72	49,6	31,2	1,698	1,403
LQ-18	38,4		16,0		1,205	
	38,28	38,34	17,3	16,7	1,240	1,222
LQ-19	38,38		16,3		1,211	
	37,66	38,02	26,3	21,3	1,419	1,315
LQ-20	38,36		16,5		1,217	
	37,6	37,98	27,3	21,9	1,437	1,327
LQ-21	37,87		22,8		1,359	
	37,36	37,62	32,0	27,4	1,506	1,432
LQ-22	37,74		24,8		1,396	
	39	38,37	10,7	17,8	1,031	1,214
LQ-23	37,49		29,3		1,469	
	37,43	37,46	30,6	30,0	1,486	1,477
LQ-24	37,06		39,1		1,593	
	39,39	38,23	8,3	23,7	0,918	1,256
LQ-25	37,78		24,2		1,385	
	37,44	37,61	30,4	27,3	1,483	1,434
LQ-26	38,38		16,2		1,211	
	38,67	38,52	13,4	14,8	1,127	1,169
LQ-27	37,5		29,1		1,466	
	37,92	37,71	22,0	25,6	1,344	1,405
LQ-28	38,8		12,3		1,089	
	38,04	38,42	20,4	16,3	1,309	1,199
LQ-29	39,12		9,9		0,996	
	37,24	38,18	34,7	22,3	1,541	1,269
LQ-30	37,81		23,8		1,376	
	37,91	37,86	22,2	23,0	1,347	1,361

Moyenne **x'**	1,337
Ecart-type **s**	0,102
Biais	0,059
Exactitude de LQ E_{LQ}	0,117
Incertitude U_{LQ}	0,240

Appendix 5: Yield and robustness

Results from iQ-Check™ Quanti L. pneumophila – Extension 2011 - v01 achieved by IPL santé, environnement durables Nord

Robustesse Eau Chaude Sanitaire

Niveau N1
100 000 UG/L

Protocole Aquadien

Echantillon	Valeur du dopage UG/puits	A (log)	Résultat analyse C(t)	UG/puits	Moyenne UG/puits	B (log)	Rendement log	%
EC1N1	4,96E+02	4,90	29,41	1,43E+03	1,32E+03	4,63	-0,27	53%
			29,65	1,23E+03				
EC2N1	4,96E+02	4,90	29,81	1,11E+03	1,04E+03	4,52	-0,38	42%
			29,99	9,83E+02				
EC3N1	5,04E+02	4,91	29,54	1,20E+03	1,27E+03	4,61	-0,30	50%
			29,39	1,33E+03				
EC4N1	5,04E+02	4,91	29,40	1,32E+03	1,26E+03	4,60	-0,30	50%
			29,56	1,19E+03				
EC5N1	5,32E+02	4,93	29,62	1,51E+03	1,31E+03	4,62	-0,31	49%
			30,07	1,14E+03				
EC6N1	5,32E+02	4,93	30,34	9,63E+02	6,86E+02	4,34	-0,59	26%
			31,43	4,89E+02				
EC7N1-100	3,08E+04	6,69	31,05	5,03E+02	4,86E+02	6,19	-0,50	32%
			31,15	4,69E+02				
EC8N1-100	3,08E+04	6,69	31,10	4,86E+02	4,72E+02	6,18	-0,51	31%
			31,18	4,58E+02				
EC9N1	6,17E+03	5,99	25,95	1,28E+04	1,25E+04	5,80	-0,39	41%
			26,02	1,22E+04				
EC10N1	8,33E+03	6,12	26,2	1,45E+04	1,38E+04	5,65	-0,45	35%
			26,35	1,31E+04				

Rendement moyen pour le niveau 100 000 UG/L **-0,40** 40%

Niveau N2
1 000 UG/L

Protocole Aquadien

Echantillon	Valeur du dopage UG/puits	A (log)	Résultat analyse C(t)	UG/puits	Moyenne UG/puits	B (log)	Rendement log	%
EC1N2	4,96E+02	4,90	30,69	6,26E+02	5,66E+02	4,31	-0,59	26%
			31,00	5,12E+02				
EC2N2	5,32E+02	4,93	37,65	1,02E+01	1,02E+01	4,51	-0,42	38%
			38,55	5,84E+00				
EC3N2	3,08E+04	6,69	30,48	7,48E+02	7,03E+02	6,35	-0,34	46%
			30,66	6,60E+02				
EC4N2	3,08E+04	6,69	30,43	7,71E+02	7,55E+02	6,38	-0,31	49%
			30,5	7,39E+02				
EC5N2	3,08E+04	6,69	30,52	7,26E+02	7,20E+02	6,36	-0,33	47%
			30,55	7,13E+02				
EC6N2	6,17E+03	5,99	32,94	1,36E+02	1,36E+02	5,64	-0,36	44%
			32,93	1,36E+02				
EC7N2	8,33E+03	6,12	33,03	1,15E+02	1,17E+02	5,57	-0,53	30%
			32,99	1,19E+02				
EC8N2	8,33E+03	6,12	33,04	1,14E+02	1,19E+02	5,58	-0,52	30%
			32,94	1,23E+02				
EC9N2	8,33E+03	6,12	32,60	1,57E+02	1,38E+02	5,65	-0,48	33%
			32,95	1,22E+02				
EC10N2	8,33E+03	6,12	32,67	1,49E+02	1,49E+02	5,68	-0,45	36%
			32,68	1,48E+02				

Rendement moyen pour le niveau 1 000 UG/L **-0,41** 39%

Protocole Aquadien W2

Echantillon	Valeur du dopage UG/puits	A (log)	Résultat analyse C(t)	UG/puits	Moyenne UG/puits	B (log)	Rendement log	%
EC1N1W	5,32E+02	4,93	31,18	5,70E+02	5,49E+02	4,30	-0,63	23%
			31,30	5,30E+02				
EC2N1W	3,08E+04	6,69	31,28	4,28E+02	3,88E+02	6,15	-0,55	28%
			31,56	3,52E+02				
EC3N1W-100	3,08E+04	6,69	31,35	4,08E+02	4,18E+02	6,18	-0,52	31%
			31,28	4,28E+02				
EC4N1W-100	3,08E+04	6,69	31,44	3,84E+02	3,71E+02	6,13	-0,57	27%
			31,54	3,59E+02				
EC5N1W-100	6,17E+03	5,99	26,73	7,66E+03	7,78E+03	5,45	-0,55	28%
			26,7	7,88E+03				
EC6N1W	7,28E+03	6,07	26,63	9,72E+03	9,37E+03	5,53	-0,54	29%
			26,75	9,03E+03				
EC7N1W	7,28E+03	6,07	26,99	7,69E+03	8,00E+03	5,46	-0,61	25%
			26,87	8,32E+03				
EC8N1W	7,28E+03	6,07	26,63	9,72E+03	9,37E+03	5,53	-0,54	29%
			26,75	9,03E+03				
EC9N1W	8,33E+03	6,12	26,79	9,60E+03	9,92E+03	5,55	-0,55	28%
			26,7	1,02E+04				
EC10N1W	8,33E+03	6,12	26,8	9,53E+03	9,95E+03	5,55	-0,55	28%
			26,68	1,04E+04				

Rendement moyen pour le niveau 100 000 UG/L **-0,56** 28%

Echantillon	Valeur du dopage UG/puits	A (log)	Résultat analyse C(t)	UG/puits	Moyenne UG/puits	B (log)	Rendement log	%
EC1N2W	5,32E+02	4,93	37,91	8,69E+00	8,69E+00	4,50	-0,43	37%
			39,7	2,84E+00				
EC2N2W	6,17E+03	5,99	33,04	1,28E+02	1,23E+02	5,65	-0,347552	45%
			33,15	1,19E+02				
EC3N2W	7,28E+03	6,07	33,64	9,48E+01	1,09E+02	5,59	-0,47	34%
			33,21	1,26E+02				
EC4N2W	7,28E+03	6,07	33,34	1,16E+02	1,23E+02	5,65	-0,42	38%
			33,16	1,30E+02				
EC5N2W	7,28E+03	6,07	33,18	1,29E+02	1,33E+02	5,68	-0,39	41%
			33,08	1,37E+02				
EC6N2W	7,28E+03	6,07	33,38	1,13E+02	1,21E+02	5,64	-0,43	37%
			33,17	1,30E+02				
EC7N2W	8,33E+03	6,12	33,22	1,01E+02	9,51E+01	5,53	-0,57	27%
			33,39	8,96E+01				
EC8N2W	8,33E+03	6,12	33,47	8,41E+01	9,58E+01	5,54	-0,56	27%
			33,1	1,09E+02				
EC9N2W	8,33E+03	6,12	33,12	1,08E+02	1,10E+02	5,60	-0,53	30%
			33,08	1,11E+02				
EC10N2W	8,33E+03	6,12	33,17	1,04E+02	1,08E+02	5,58	-0,54	29%
			33,13	1,08E+02				

Rendement moyen pour le niveau 1 000 UG/L **-0,47** 34%

Rendement moyen Eau chaude sanitaire Aquadien W2 **-0,51** 31%

Rendement moyen Eau chaude sanitaire Aquadien **-0,41** 39%

Rendement et Robustesse

Robustesse Tour Aéroréfrigérante

Protocole Aquadien

Niveau N1
100 000 UG/L

Echantillon	Valeur du dopage UG/puits	A (log)	Résultat analyse C(t)	UG/puits	Moyenne UG/puits	B (log)	Rendement log	%
T1N1	6,17E+03	5,99	26,48 26,51	9,03E+03 8,91E+03	8,97E+03	5,46	-0,54	29%
T2N1	7,28E+03	6,07	26,57 26,45	1,01E+04 1,10E+04	1,06E+04	5,53	-0,54	29%
T3N1	7,28E+03	6,07	26,41 26,39	1,13E+04 1,14E+04	1,14E+04	5,56	-0,51	31%
T4N1	7,28E+03	6,07	26,39 26,32	1,14E+04 1,20E+04	1,17E+04	5,57	-0,49	32%
T5N1	7,28E+03	6,07	26,3 26,36	1,21E+04 1,16E+04	1,19E+04	5,58	-0,49	33%
T6N1	8,33E+03	6,12	26,36 26,31	1,30E+04 1,35E+04	1,33E+04	5,63	-0,47	34%
T7N1	8,33E+03	6,12	26,61 26,54	1,09E+04 1,15E+04	1,12E+04	5,55	-0,55	28%
T8N1	8,33E+03	6,12	26,45 26,44	1,22E+04 1,23E+04	1,23E+04	5,59	-0,51	31%
T9N1	8,33E+03	6,12	26,37 26,31	1,30E+04 1,35E+04	1,32E+04	5,63	-0,50	32%
T10N1	8,33E+03	6,12	26,24 26,37	1,42E+04 1,30E+04	1,36E+04	5,64	-0,49	33%

Rendement moyen pour le niveau 100 000 UG/L **-0,51** 31%

Niveau N2
1 000 UG/L

Echantillon	Valeur du dopage UG/puits	A (log)	Résultat analyse C(t)	UG/puits	Moyenne UG/puits	B (log)	Rendement log	%
T1N2	5,04E+02	4,91	36,67 35,72	1,16E+01 2,15E+01	2,15E+01	4,84	-0,07	85%
T2N2	5,04E+02	4,91	36,37 35,56	1,41E+01 2,39E+01	2,39E+01	4,88	-0,02	95%
T3N2	5,32E+02	4,93	36,39 37,75	2,23E+01 9,60E+00	1,46E+01	4,67	-0,26	55%
T4N2	4,96E+02	4,90	36,29 36,38	1,70E+01 1,61E+01	1,65E+01	4,72	-0,18	67%
T5N2	4,96E+02	4,90	35,51 37,83	2,81E+01 6,33E+00	2,81E+01	4,95	0,05	113%
T6N2	3,08E+04	6,69	30,17 30,21	9,27E+02 8,98E+02	9,12E+02	6,47	-0,23	59%
T7N2	3,08E+04	6,69	30,28 30,26	8,56E+02 8,73E+02	8,65E+02	6,44	-0,25	56%
T8N2	3,08E+04	6,69	30,43 29,9	7,76E+02 1,11E+03	9,30E+02	6,47	-0,22	60%
T9N2	3,08E+04	6,69	30,36 30,22	8,02E+02 8,83E+02	8,42E+02	6,43	-0,26	55%
T10N2	6,17E+03	5,99	32,72 32,82	1,56E+02 1,47E+02	1,51E+02	5,69	-0,31	49%

Rendement moyen pour le niveau 1 000 UG/L **-0,17** 67%

Rendement moyen Tour aéroréfrigérante Aquadien **-0,34** 46%

Protocole Aquadien W2

Echantillon	Valeur du dopage UG/puits	A (log)	Résultat analyse C(t)	UG/puits	Moyenne UG/puits	B (log)	Rendement log	%
T1N1W	4,96E+02	4,90	30,35 30,64	7,78E+02 6,45E+02	7,09E+02	4,41	-0,49	32%
T2N1W	4,96E+02	4,90	30,29 30,37	8,13E+02 7,71E+02	7,91E+02	4,45	-0,45	36%
T3N1W	5,04E+02	4,91	30,29 30,44	7,41E+02 6,74E+02	7,07E+02	4,41	-0,50	32%
T4N1W	5,04E+02	4,91	30,28 30,6	7,46E+02 6,07E+02	6,73E+02	4,38	-0,52	30%
T5N1W	5,32E+02	4,93	30,73 30,82	7,57E+02 7,14E+02	7,35E+02	4,42	-0,51	31%
T6N1W	6,17E+03	5,99	26,67 26,69	8,01E+03 7,89E+03	7,95E+03	5,46	-0,54	29%
T7N1W	7,28E+03	6,07	26,66 26,68	9,54E+03 9,43E+03	9,49E+03	5,53	-0,53	29%
T8N1W	7,28E+03	6,07	26,69 26,49	9,39E+03 1,07E+04	1,00E+04	5,56	-0,51	31%
T9N1W	8,33E+03	6,12	26,85 26,71	9,21E+03 1,02E+04	9,67E+03	5,54	-0,56	28%
T10N1W	8,33E+03	6,12	26,63 26,54	1,08E+04 1,15E+04	1,11E+04	5,60	-0,50	32%

Rendement moyen pour le niveau 100 000 UG/L **-0,51** 31%

Echantillon	Valeur du dopage UG/puits	A (log)	Résultat analyse C(t)	UG/puits	Moyenne UG/puits	B (log)	Rendement log	%
T1N2W	5,32E+02	4,93	38,66 38,16	6,43E+00 7,43E+00	6,43E+00	4,36	-0,57	27%
T2N2W	6,17E+03	5,99	33,12 33,12	1,21E+02 1,21E+02	1,21E+02	5,64	-0,36	44%
T3N2W	7,28E+03	6,07	33,34 33,54	1,16E+02 1,02E+02	1,08E+02	5,59	-0,47	34%
T4N2W	7,28E+03	6,07	33,16 33,34	1,31E+02 1,16E+02	1,23E+02	5,65	-0,42	38%
T5N2W	7,28E+03	6,07	33,25 33,14	1,23E+02 1,32E+02	1,27E+02	5,66	-0,40	39%
T6N2W	7,28E+03	6,07	32,99 32,87	1,46E+02 1,58E+02	1,51E+02	5,74	-0,33	47%
T7N2W	8,33E+03	6,12	33,15 33,28	1,06E+02 9,66E+01	1,01E+02	5,56	-0,54	29%
T8N2W	8,33E+03	6,12	33,40 33,22	8,86E+01 1,01E+02	9,44E+01	5,53	-0,57	27%
T9N2W	8,33E+03	6,12	33,20 33,09	1,02E+02 1,10E+02	1,06E+02	5,58	-0,54	29%
T10N2W	8,33E+03	6,12	33,06 32,91	1,13E+02 1,26E+02	1,19E+02	5,63	-0,49	32%

Rendement moyen pour le niveau 1 000 UG/L **-0,47** 34%

Rendement moyen Tour aéroréfrigérante Aquadien W2 **-0,49** 32%

Robustesse Eau Minérale

Protocole Aquadien

Niveau N1
100 000 UG/L

Echantillon	Valeur du dopage		Résultat analyse				Rendement	
	UG/puits	A (log)	C(t)	UG/puits	Moyenne UG/puits	B (log)	log	%
M1N1	4,96E+02	4,90	29,54	1,31E+03	1,25E+03	4,60	-0,30	50%
			29,7	1,19E+03				
M2N1	4,96E+02	4,90	29,58	1,28E+03	1,26E+03	4,61	-0,29	51%
			29,62	1,25E+03				
M3N1	5,04E+02	4,91	29,54	1,20E+03	1,26E+03	4,61	-0,30	50%
			29,41	1,32E+03				
M4N1	5,04E+02	4,91	30,05	8,65E+02	1,14E+03	4,56	-0,35	45%
			29,22	1,49E+03				
M5N1	5,32E+02	4,93	29,77	1,37E+03	1,36E+03	4,64	-0,29	51%
			29,81	1,34E+03				
M6N1-100	3,08E+04	6,69	31,02	5,13E+02	4,44E+02	6,15	-0,54	29%
			31,44	3,84E+02				
M7N1-100	3,08E+04	6,69	31,22	4,46E+02	3,93E+02	6,10	-0,59	26%
			31,59	3,47E+02				
M8N1	6,17E+03	5,99	25,9	1,32E+04	1,34E+04	5,63	-0,36	43%
			25,86	1,36E+04				
M9N1	7,28E+03	6,07	26,05	1,43E+04	1,38E+04	5,64	-0,42	38%
			26,16	1,33E+04				
M10N1	7,28E+03	6,07	26,15	1,34E+04	1,47E+04	5,67	-0,39	40%
			25,87	1,61E+04				

Rendement moyen pour le niveau 100 000 UG/L **-0,38** 41%

Niveau N2
1 000 UG/L

Echantillon	Valeur du dopage		Résultat analyse				Rendement	
	UG/puits	A (log)	C(t)	UG/puits	Moyenne UG/puits	B (log)	log	%
M1N2	4,96E+02	4,90	35,43	2,97E+01	2,97E+01	4,98	0,08	120%
			N/A	N/A				
M2N2	4,96E+02	4,90	35,05	3,79E+01	3,14E+01	5,00	0,10	126%
			35,64	2,60E+01				
M3N2	5,04E+02	4,91	34,84	3,83E+01	3,01E+01	4,98	0,08	120%
			35,57	2,37E+01				
M4N2	5,04E+02	4,91	35,55	2,41E+01	2,80E+01	4,95	0,05	111%
			35,08	3,26E+01				
M5N2	5,32E+02	4,93	37,31	1,26E+01	1,26E+01	4,61	-0,32	47%
			N/A	N/A				
M6N2	3,08E+04	6,69	29,96	1,07E+03	1,04E+03	6,52	-0,17	68%
			30,04	1,01E+03				
M7N2	3,08E+04	6,69	30,05	1,01E+03	9,39E+02	6,48	-0,21	61%
			30,25	8,76E+02				
M8N2	6,17E+03	5,99	32,99	1,32E+02	1,31E+02	5,62	-0,37	42%
			33,01	1,30E+02				
M9N2	8,33E+03	6,12	33,1	1,09E+02	1,12E+02	5,56	-0,54	29%
			33,03	1,15E+02				
M10N2	8,33E+03	6,12	32,84	1,32E+02	1,24E+02	5,60	-0,50	31%
			33,02	1,16E+02				

Rendement moyen pour le niveau 1 000 UG/L **-0,18** 66%

Rendement moyen Eau minéarle Aquadien **-0,28** 52%

Protocole Aquadien W2

Echantillon	Valeur du dopage		Résultat analyse				Rendement	
	UG/puits	A (log)	C(t)	UG/puits	Moyenne UG/puits	B (log)	log	%
M1N1W	4,96E+02	4,90	30,07	9,36E+02	9,33E+02	4,53	-0,37	42%
			30,08	9,29E+02				
M2N1W	4,96E+02	4,90	30,04	9,52E+02	9,17E+02	4,52	-0,38	42%
			30,16	8,83E+02				
M3N1W	5,04E+02	4,91	30,17	7,99E+02	8,49E+02	4,49	-0,42	38%
			29,99	9,02E+02				
M4N1W	5,04E+02	4,91	30,21	7,83E+02	8,12E+02	4,47	-0,44	36%
			30,09	8,42E+02				
M5N1W	5,32E+02	4,93	30,28	9,97E+02	9,14E+02	4,52	-0,41	39%
			30,56	8,38E+02				
M6N1W	6,17E+03	5,99	26,79	7,43E+03	7,98E+03	5,46	-0,54	29%
			26,56	8,58E+03				
M7N1W	7,28E+03	6,07	26,48	1,08E+04	1,08E+04	5,59	-0,48	33%
			26,48	1,08E+04				
M8N1W	7,28E+03	6,07	26,44	1,10E+04	1,11E+04	5,60	-0,46	34%
			26,42	1,12E+04				
M9N1W	7,28E+03	6,07	26,4	1,14E+04	1,12E+04	5,61	-0,46	35%
			26,45	1,10E+04				
M10N1W	8,33E+03	6,12	26,41	1,26E+04	1,21E+04	5,64	-0,46	35%
			26,51	1,17E+04				

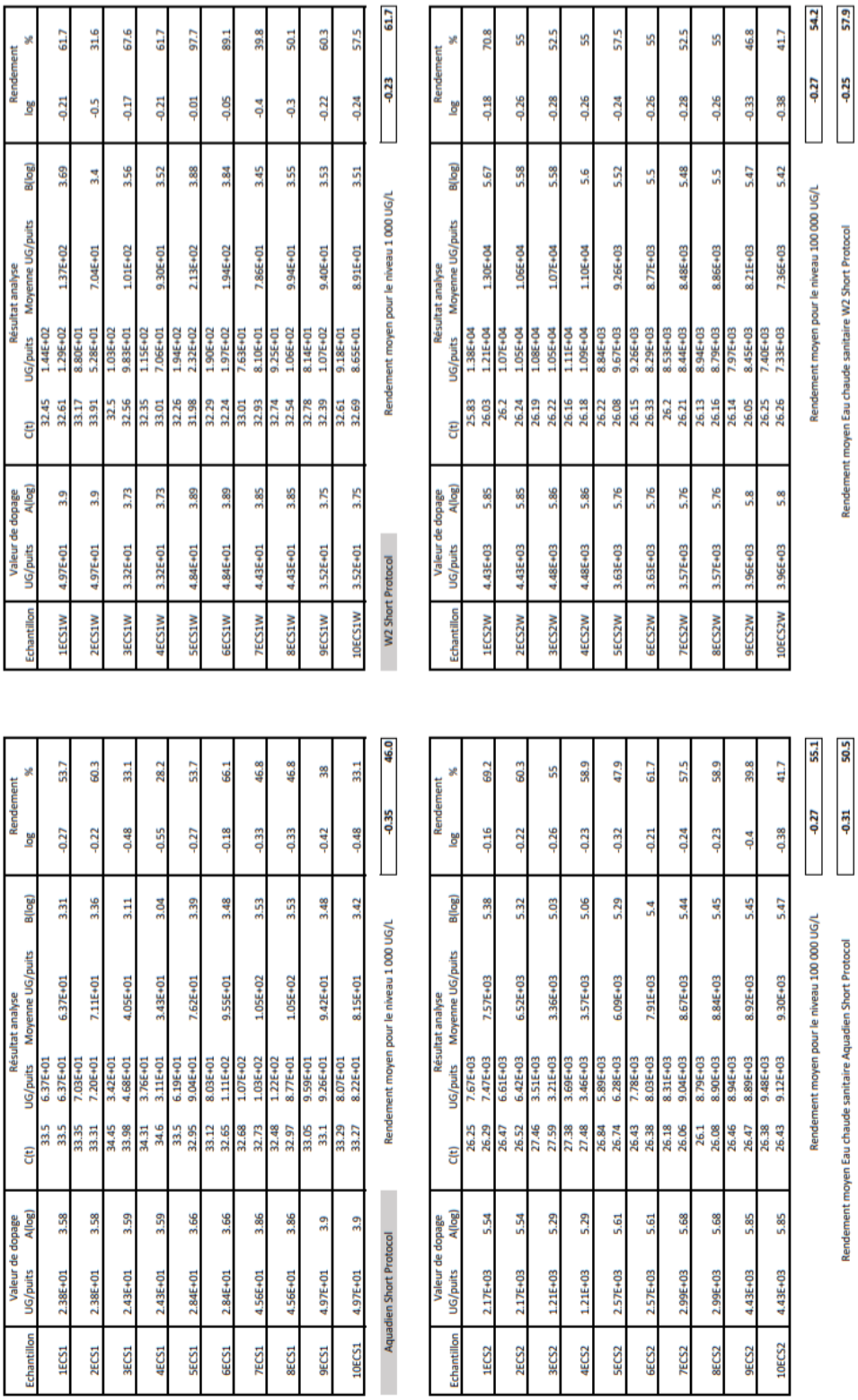
Rendement moyen pour le niveau 100 000 UG/L **-0,44** 36%

Echantillon	Valeur du dopage		Résultat analyse				Rendement	
	UG/puits	A (log)	C(t)	UG/puits	Moyenne UG/puits	B (log)	log	%
M1N2W	6,17E+03	5,99	33,61	8,80E+01	9,73E+01	5,54	-0,45	35%
			33,3	1,08E+02				
M2N2W	7,28E+03	6,07	33,99	7,51E+01	8,90E+01	5,51	-0,56	28%
			33,48	1,06E+02				
M3N2W	7,28E+03	6,07	31,52	3,86E+02	2,05E+02	5,87	-0,20	63%
			33,43	1,09E+02				
M4N2W	7,28E+03	6,07	33,47	1,06E+02	1,12E+02	5,61	-0,46	35%
			33,3	1,19E+02				
M5N2W	7,28E+03	6,07	33,19	1,28E+02	1,16E+02	5,62	-0,45	36%
			33,49	1,05E+02				
M6N2W	8,33E+03	6,12	33,45	8,54E+01	8,95E+01	5,51	-0,59	26%
			33,32	9,39E+01				
M7N2W	7,17E+03	6,06	33,2	1,02E+02	9,92E+01	5,55	-0,51	31%
			33,26	9,70E+01				
M8N2W	7,17E+03	6,06	33,14	1,06E+02	9,88E+01	5,55	-0,51	31%
			33,34	9,22E+01				
M9N2W	7,17E+03	6,06	33,12	1,07E+02	1,05E+02	5,58	-0,49	33%
			33,17	1,03E+02				
M10N2W	7,17E+03	6,06	33,02	1,14E+02	1,11E+02	5,60	-0,46	34%
			33,12	1,07E+02				

Rendement moyen pour le niveau 1 000 UG/L **-0,47** 34%

Rendement moyen Eau minérale Aquadien W2 **-0,45** 35%

Robustesse Eau chaude sanitaire



Echantillon	Valeur de dopage UG/puits	Valeur de dopage A(log)	Résultat analyse C(t)	Résultat analyse UG/puits	Résultat analyse Moyenne UG/puits	Résultat analyse B(log)	Rendement log	Rendement %
1ECS1	2.38E+01	3.58	33.5	6.37E+01				
			33.5	6.37E+01	6.37E+01	3.31	-0.27	53.7
2ECS1	2.38E+01	3.58	33.35	7.03E+01				
			33.31	7.20E+01	7.11E+01	3.36	-0.22	60.3
3ECS1	2.43E+01	3.59	34.45	3.42E+01				
			33.98	4.68E+01	4.05E+01	3.11	-0.48	33.1
4ECS1	2.43E+01	3.59	34.31	3.76E+01				
			34.6	3.11E+01	3.43E+01	3.04	-0.55	28.2
5ECS1	2.84E+01	3.66	33.5	6.19E+01				
			32.95	9.04E+01	7.62E+01	3.39	-0.27	53.7
6ECS1	2.84E+01	3.66	33.12	8.03E+01				
			32.65	1.11E+02	9.55E+01	3.48	-0.18	66.1
7ECS1	4.56E+01	3.86	32.68	1.07E+02				
			32.73	1.03E+02	1.05E+02	3.53	-0.33	46.8
8ECS1	4.56E+01	3.86	32.48	1.22E+02				
			32.97	8.77E+01	1.05E+02	3.53	-0.33	46.8
9ECS1	4.97E+01	3.9	33.05	9.59E+01				
			33.1	9.26E+01	9.42E+01	3.48	-0.42	38
10ECS1	4.97E+01	3.9	33.29	8.07E+01				
			33.27	8.22E+01	8.15E+01	3.42	-0.48	33.1
Aquadien Short Protocol			Rendement moyen pour le niveau 1 000 UG/L				-0.35	46.0

Echantillon	Valeur de dopage UG/puits	Valeur de dopage A(log)	Résultat analyse C(t)	Résultat analyse UG/puits	Résultat analyse Moyenne UG/puits	Résultat analyse B(log)	Rendement log	Rendement %
1ECS2	2.17E+03	5.54	26.25	7.67E+03				
			26.29	7.47E+03	7.57E+03	5.38	-0.16	69.2
2ECS2	2.17E+03	5.54	26.47	6.61E+03				
			26.52	6.42E+03	6.52E+03	5.32	-0.22	60.3
3ECS2	1.21E+03	5.29	27.46	3.51E+03				
			27.59	3.21E+03	3.36E+03	5.03	-0.26	55
4ECS2	1.21E+03	5.29	27.38	3.69E+03				
			27.48	3.46E+03	3.57E+03	5.06	-0.23	58.9
5ECS2	2.57E+03	5.61	26.84	5.89E+03				
			26.74	6.28E+03	6.09E+03	5.29	-0.32	47.9
6ECS2	2.57E+03	5.61	26.43	7.78E+03				
			26.38	8.03E+03	7.91E+03	5.4	-0.21	61.7
7ECS2	2.99E+03	5.68	26.18	8.31E+03				
			26.06	9.04E+03	8.67E+03	5.44	-0.24	57.5
8ECS2	2.99E+03	5.68	26.1	8.79E+03				
			26.08	8.90E+03	8.84E+03	5.45	-0.23	58.9
9ECS2	4.43E+03	5.85	26.46	8.94E+03				
			26.47	8.89E+03	8.92E+03	5.45	-0.4	39.8
10ECS2	4.43E+03	5.85	26.38	9.48E+03				
			26.43	9.12E+03	9.30E+03	5.47	-0.38	41.7
Rendement moyen Eau chaude sanitaire Aquadien Short Protocol			Rendement moyen pour le niveau 100 000 UG/L				-0.27	55.1
			Rendement moyen pour le niveau 1 000 UG/L				-0.31	50.5

Echantillon	Valeur de dopage UG/puits	Valeur de dopage A(log)	Résultat analyse C(t)	Résultat analyse UG/puits	Résultat analyse Moyenne UG/puits	Résultat analyse B(log)	Rendement log	Rendement %
1EC51W	4.97E+01	3.9	32.45	1.44E+02				
			32.61	1.29E+02	1.37E+02	3.69	-0.21	61.7
2EC51W	4.97E+01	3.9	33.17	8.80E+01				
			33.91	5.28E+01	7.04E+01	3.4	-0.5	31.6
3EC51W	3.32E+01	3.73	32.5	1.03E+02				
			32.56	9.83E+01	1.01E+02	3.56	-0.17	67.6
4EC51W	3.32E+01	3.73	32.35	1.15E+02				
			33.01	7.06E+01	9.30E+01	3.52	-0.21	61.7
5EC51W	4.84E+01	3.89	32.26	1.94E+02				
			31.98	2.32E+02	2.13E+02	3.88	-0.01	97.7
6EC51W	4.84E+01	3.89	32.29	1.90E+02				
			32.24	1.97E+02	1.94E+02	3.84	-0.05	89.1
7EC51W	4.43E+01	3.85	33.01	7.63E+01				
			32.93	8.10E+01	7.86E+01	3.45	-0.4	39.8
8EC51W	4.43E+01	3.85	32.74	9.25E+01				
			32.54	1.05E+02	9.94E+01	3.55	-0.3	50.1
9EC51W	3.52E+01	3.75	32.78	8.14E+01				
			32.39	1.07E+02	9.40E+01	3.53	-0.22	60.3
10EC51W	3.52E+01	3.75	32.61	9.18E+01				
			32.69	8.65E+01	8.91E+01	3.51	-0.24	57.5
W2 Short Protocol			Rendement moyen pour le niveau 1 000 UG/L				-0.23	61.7

Echantillon	Valeur de dopage UG/puits	Valeur de dopage A(log)	Résultat analyse C(t)	Résultat analyse UG/puits	Résultat analyse Moyenne UG/puits	Résultat analyse B(log)	Rendement log	Rendement %
1EC52W	4.43E+03	5.85	25.83	1.38E+04				
			26.03	1.21E+04	1.30E+04	5.67	-0.18	70.8
2EC52W	4.43E+03	5.85	26.2	1.07E+04				
			26.24	1.05E+04	1.06E+04	5.58	-0.26	55
3EC52W	4.48E+03	5.86	26.19	1.08E+04				
			26.22	1.05E+04	1.07E+04	5.58	-0.28	52.5
4EC52W	4.48E+03	5.86	26.16	1.11E+04				
			26.18	1.09E+04	1.10E+04	5.6	-0.26	55
5EC52W	3.63E+03	5.76	26.22	8.84E+03				
			26.08	9.67E+03	9.26E+03	5.52	-0.24	57.5
6EC52W	3.63E+03	5.76	26.15	9.26E+03				
			26.33	8.29E+03	8.77E+03	5.5	-0.26	55
7EC52W	3.57E+03	5.76	26.2	8.53E+03				
			26.21	8.44E+03	8.48E+03	5.48	-0.28	52.5
8EC52W	3.57E+03	5.76	26.13	8.94E+03				
			26.16	8.79E+03	8.86E+03	5.5	-0.26	55
9EC52W	3.96E+03	5.8	26.14	7.97E+03				
			26.05	8.45E+03	8.21E+03	5.47	-0.33	46.8
10EC52W	3.96E+03	5.8	26.25	7.40E+03				
			26.26	7.33E+03	7.36E+03	5.42	-0.38	41.7
Rendement moyen Eau chaude sanitaire W2 Short Protocol			Rendement moyen pour le niveau 100 000 UG/L				-0.27	54.2
			Rendement moyen pour le niveau 1 000 UG/L				-0.25	57.9

Echantillon	Valeur de dopage UG/puits	A(log)	Résultat analyse C(t)	UG/puits	Moyenne UG/puits	B(log)	Rendement log	%
1ECS1F	2.38E+01	3.58	33.12 32.88	8.21E+01 9.61E+01	8.91E+01	3.51	-0.07	85.1
2ECS1F	2.38E+01	3.58	33.45 33.37	6.58E+01 6.92E+01	6.75E+01	3.39	-0.19	64.6
3ECS1F	2.43E+01	3.59	33.55 33.39	6.21E+01 6.91E+01	6.56E+01	3.37	-0.22	60.3
4ECS1F	2.43E+01	3.59	33.19 33.33	7.88E+01 7.21E+01	7.55E+01	3.43	-0.16	69.2
5ECS1F	2.84E+01	3.66	33.69 33.43	5.46E+01 6.50E+01	5.98E+01	3.33	-0.33	46.77
6ECS1F	2.84E+01	3.66	32.96 32.78	8.99E+01 1.02E+02	9.58E+01	3.54	-0.12	75.9
7ECS1F	4.56E+01	3.86	33.24 32.69	7.34E+01 1.06E+02	8.99E+01	3.51	-0.35	44.7
8ECS1F	4.56E+01	3.86	32.47 32.72	1.23E+02 1.04E+02	1.13E+02	3.61	-0.25	56.2
9ECS1F	4.97E+01	3.9	32.86 32.55	1.09E+02 1.35E+02	1.22E+02	3.64	-0.26	55
10ECS1F	4.97E+01	3.9	33.22 32.71	8.59E+01 1.21E+02	1.03E+02	3.57	-0.33	46.8

FDRS Short Protocol

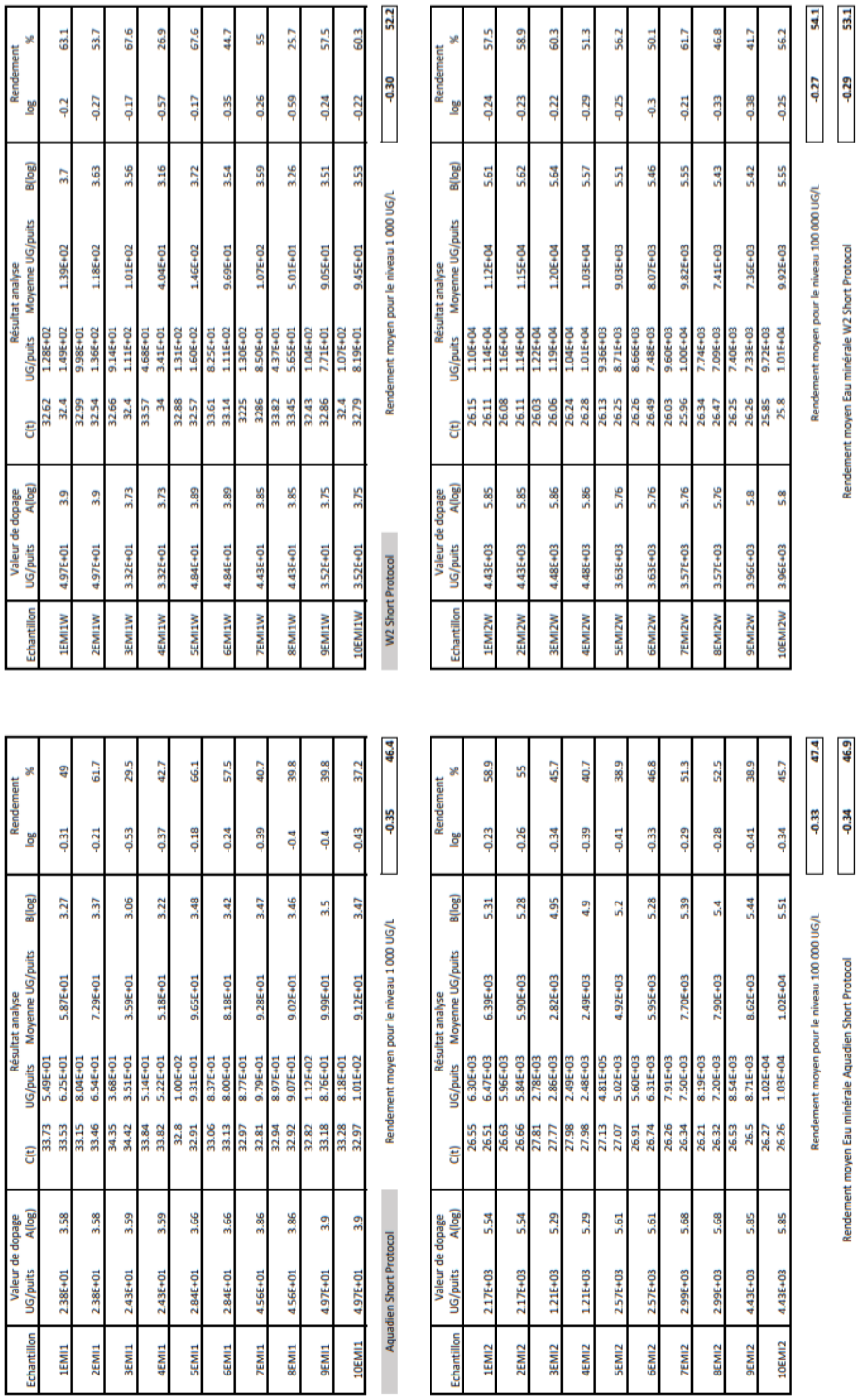
Rendement moyen pour le niveau 1 000 UG/L: -0.23 | 60.5

Echantillon	Valeur de dopage UG/puits	A(log)	Résultat analyse C(t)	UG/puits	Moyenne UG/puits	B(log)	Rendement log	%
1ECS2F	2.17E+03	5.54	27.04 27.1	4.55E+03 4.38E+03	4.46E+03	5.21	-0.33	46.8
2ECS2F	2.17E+03	5.54	27.36 27.38	3.68E+03 3.65E+03	3.66E+03	5.12	-0.42	38
3ECS2F	1.21E+03	5.29	27.69 27.78	3.00E+03 2.83E+03	2.92E+03	5.02	-0.27	53.7
4ECS2F	1.21E+03	5.29	27.82 27.92	2.77E+03 2.58E+03	2.67E+03	4.98	-0.31	49
5ECS2F	2.57E+03	5.61	26.57 26.45	7.08E+03 7.65E+03	7.37E+03	5.42	-0.19	64.6
6ECS2F	2.57E+03	5.61	26.83 26.86	5.92E+03 5.78E+03	5.85E+03	5.32	-0.29	51.3
7ECS2F	2.99E+03	5.68	26.05 26.02	9.09E+03 9.28E+03	9.19E+03	5.52	-0.16	69.2
8ECS2F	2.99E+03	5.68	26.05 25.93	9.07E+03 9.85E+03	9.46E+03	5.53	-0.15	70.8
9ECS2F	4.43E+03	5.85	26.23 26.1	1.05E+04 1.15E+04	1.10E+04	5.6	-0.25	56.2
10ECS2F	4.43E+03	5.85	26.33 26.37	9.76E+03 9.53E+03	9.65E+03	5.54	-0.31	49

Rendement moyen pour le niveau 100 000 UG/L: -0.27 | 54.9

Rendement moyen Eau chaude sanitaire FDRS Short Protocol: -0.25 | 57.7

Robustesse Eau minérale



Echantillon	Valeur de dopage UG/puits	A(log)	Résultat analyse C(t)	UG/puits	Moyenne UG/puits	B(log)	Rendement log	%
1EMI1	2.38E+01	3.58	33.73	5.49E+01				
			33.53	6.25E+01	5.87E+01	3.27	-0.31	49
2EMI1	2.38E+01	3.58	33.15	8.04E+01				
			33.46	6.54E+01	7.29E+01	3.37	-0.21	61.7
3EMI1	2.43E+01	3.59	34.35	3.68E+01				
			34.42	3.51E+01	3.59E+01	3.06	-0.53	29.5
4EMI1	2.43E+01	3.59	33.84	5.14E+01				
			33.82	5.22E+01	5.18E+01	3.22	-0.37	42.7
5EMI1	2.84E+01	3.66	32.8	1.00E+02				
			32.91	9.31E+01	9.65E+01	3.48	-0.18	66.1
6EMI1	2.84E+01	3.66	33.06	8.37E+01				
			33.13	8.00E+01	8.18E+01	3.42	-0.24	57.5
7EMI1	4.56E+01	3.86	32.97	8.77E+01				
			32.81	9.79E+01	9.28E+01	3.47	-0.39	40.7
8EMI1	4.56E+01	3.86	32.94	8.97E+01				
			32.92	9.07E+01	9.02E+01	3.46	-0.4	39.8
9EMI1	4.97E+01	3.9	32.82	1.12E+02				
			33.18	8.76E+01	9.99E+01	3.5	-0.4	39.8
10EMI1	4.97E+01	3.9	33.28	8.18E+01				
			32.97	1.01E+02	9.12E+01	3.47	-0.43	37.2

Aquadien Short Protocol — Rendement moyen pour le niveau 1 000 UG/L: **-0.35** — **46.4**

Echantillon	Valeur de dopage UG/puits	A(log)	Résultat analyse C(t)	UG/puits	Moyenne UG/puits	B(log)	Rendement log	%
1EMI2	2.17E+03	5.54	26.55	6.30E+03				
			26.51	6.47E+03	6.39E+03	5.31	-0.23	58.9
2EMI2	2.17E+03	5.54	26.63	5.96E+03				
			26.66	5.84E+03	5.90E+03	5.28	-0.26	55
3EMI2	1.21E+03	5.29	27.81	2.78E+03				
			27.77	2.86E+03	2.82E+03	4.95	-0.34	45.7
4EMI2	1.21E+03	5.29	27.98	2.49E+03				
			27.98	2.48E+03	2.49E+03	4.9	-0.39	40.7
5EMI2	2.57E+03	5.61	27.13	4.81E+05				
			27.07	5.02E+03	4.92E+03	5.2	-0.41	38.9
6EMI2	2.57E+03	5.61	26.91	5.60E+03				
			26.74	6.31E+03	5.95E+03	5.28	-0.33	46.8
7EMI2	2.99E+03	5.68	26.26	7.91E+03				
			26.34	7.50E+03	7.70E+03	5.39	-0.29	51.3
8EMI2	2.99E+03	5.68	26.21	8.19E+03				
			26.32	7.20E+03	7.90E+03	5.4	-0.28	52.5
9EMI2	4.43E+03	5.85	26.53	8.54E+03				
			26.5	8.71E+03	8.62E+03	5.44	-0.41	38.9
10EMI2	4.43E+03	5.85	26.27	1.02E+04				
			26.26	1.03E+04	1.02E+04	5.51	-0.34	45.7

Rendement moyen pour le niveau 100 000 UG/L: **-0.33** — **47.4**

Rendement moyen Eau minérale Aquadien Short Protocol: **-0.34** — **46.9**

Echantillon	Valeur de dopage UG/puits	A(log)	Résultat analyse C(t)	UG/puits	Moyenne UG/puits	B(log)	Rendement log	%
1EMI1W	4.97E+01	3.9	32.62	1.28E+02				
			33.4	1.49E+02	1.39E+02	3.7	-0.2	63.1
2EMI1W	4.97E+01	3.9	32.99	9.98E+01				
			32.54	1.36E+02	1.18E+02	3.63	-0.27	53.7
3EMI1W	3.32E+01	3.73	32.66	9.14E+01				
			32.4	1.11E+02	1.01E+02	3.56	-0.17	67.6
4EMI1W	3.32E+01	3.73	33.57	4.68E+01				
			34	3.41E+01	4.04E+01	3.16	-0.57	26.9
5EMI1W	4.84E+01	3.89	32.88	1.31E+02				
			32.57	1.60E+02	1.46E+02	3.72	-0.17	67.6
6EMI1W	4.84E+01	3.89	33.61	8.25E+01				
			33.14	1.11E+02	9.69E+01	3.54	-0.35	44.7
7EMI1W	4.43E+01	3.85	3225	1.30E+02				
			3286	8.50E+01	1.07E+02	3.59	-0.26	55
8EMI1W	4.43E+01	3.85	33.82	4.37E+01				
			33.45	5.65E+01	5.01E+01	3.26	-0.59	25.7
9EMI1W	3.52E+01	3.75	32.43	1.04E+02				
			32.86	7.71E+01	9.05E+01	3.51	-0.24	57.5
10EMI1W	3.52E+01	3.75	32.4	1.07E+02				
			32.79	8.19E+01	9.45E+01	3.53	-0.22	60.3

W2 Short Protocol — Rendement moyen pour le niveau 1 000 UG/L: **-0.30** — **52.2**

Echantillon	Valeur de dopage UG/puits	A(log)	Résultat analyse C(t)	UG/puits	Moyenne UG/puits	B(log)	Rendement log	%
1EMI2W	4.43E+03	5.85	26.15	1.10E+04				
			26.11	1.14E+04	1.12E+04	5.61	-0.24	57.5
2EMI2W	4.43E+03	5.85	26.08	1.16E+04				
			26.11	1.14E+04	1.15E+04	5.62	-0.23	58.9
3EMI2W	4.48E+03	5.86	26.03	1.22E+04				
			26.06	1.19E+04	1.20E+04	5.64	-0.22	60.3
4EMI2W	4.48E+03	5.86	26.24	1.04E+04				
			26.28	1.01E+04	1.03E+04	5.57	-0.29	51.3
5EMI2W	3.63E+03	5.76	26.13	9.36E+03				
			26.25	8.71E+03	9.03E+03	5.51	-0.25	56.2
6EMI2W	3.63E+03	5.76	26.26	8.66E+03				
			26.49	7.48E+03	8.07E+03	5.46	-0.3	50.1
7EMI2W	3.57E+03	5.76	26.03	9.60E+03				
			25.96	1.00E+04	9.82E+03	5.55	-0.21	61.7
8EMI2W	3.57E+03	5.76	26.34	7.74E+03				
			26.47	7.09E+03	7.41E+03	5.43	-0.33	46.8
9EMI2W	3.96E+03	5.8	26.25	7.40E+03				
			26.26	7.33E+03	7.36E+03	5.42	-0.38	41.7
10EMI2W	3.96E+03	5.8	25.85	9.72E+03				
			25.8	1.01E+04	9.92E+03	5.55	-0.25	56.2

Rendement moyen pour le niveau 100 000 UG/L: **-0.27** — **54.1**

Rendement moyen Eau minérale W2 Short Protocol: **-0.29** — **53.1**

Echantillon	Valeur de dopage UG/puits	A(log)	Résultat analyse C(t)	UG/puits	Moyenne UG/puits	B(log)	Rendement log	%
1EMI1F	2.38E+01	3.58	33.87 33.94	4.98E+01 4.76E+01	4.87E+01	3.24	-0.34	45.7
2EMI1F	2.38E+01	3.58	34.59 34.53	3.10E+01 3.23E+01	3.16E+01	3.06	-0.52	30.2
3EMI1F	2.43E+01	3.59	33.58 33.53	6.10E+01 6.28E+01	6.19E+01	3.35	-0.24	57.5
4EMI1F	2.43E+01	3.59	33.26 33.18	7.51E+01 7.92E+01	7.72E+01	3.44	-0.15	70.8
5EMI1F	2.84E+01	3.66	33.56 33.6	5.97E+01 5.80E+01	5.89E+01	3.33	-0.33	46.77
6EMI1F	2.84E+01	3.66	34.13 33.82	4.03E+01 4.98E+01	4.51E+01	3.21	-0.45	35.5
7EMI1F	4.56E+01	3.86	33.35 33.02	6.83E+01 8.49E+01	7.66E+01	3.44	-0.42	38.1
8EMI1F	4.56E+01	3.86	32.4 32.54	1.29E+02 1.17E+02	1.23E+02	3.65	-0.21	61.7
9EMI1F	4.97E+01	3.9	32.09 31.98	1.85E+02 1.99E+02	1.92E+02	3.84	-0.06	87.1
10EMI1F	4.97E+01	3.9	32.57 32.7	1.33E+02 1.22E+02	1.28E+02	3.63	-0.27	53.7

FDRS Short Protocol

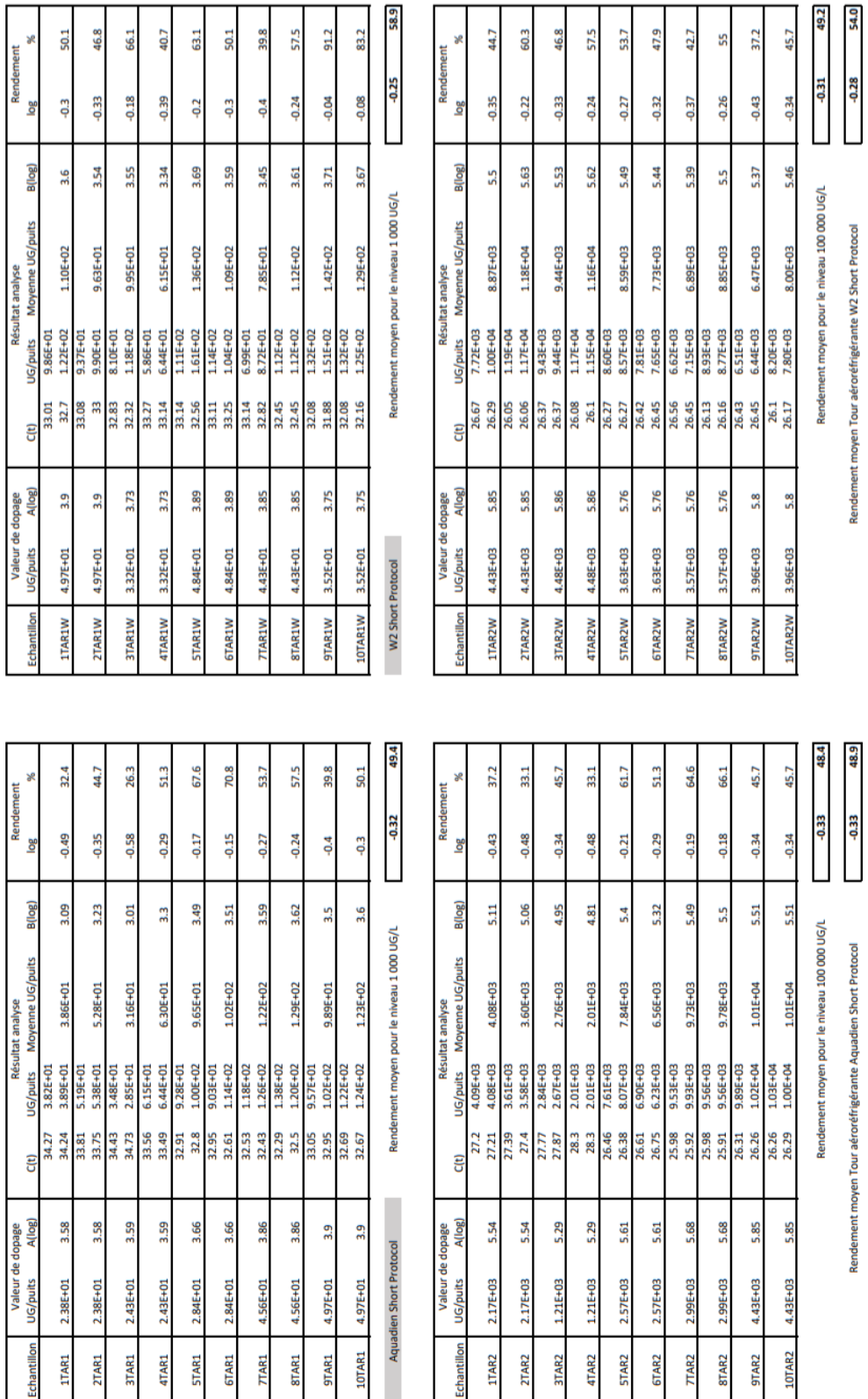
Rendement moyen pour le niveau 1 000 UG/L: **-0.30** | **52.7**

Echantillon	Valeur de dopage UG/puits	A(log)	Résultat analyse C(t)	UG/puits	Moyenne UG/puits	B(log)	Rendement log	%
1EMI2F	2.17E+03	5.54	27.68 27.66	2.98E+03 3.02E+03	3.00E+03	5.03	-0.51	30.9
2EMI2F	2.17E+03	5.54	27.45 27.39	3.46E+03 3.60E+03	3.03E+03	5.04	-0.5	31.6
3EMI2F	1.21E+03	5.29	28.37 28.29	1.92E+03 2.02E+03	1.97E+03	4.85	-0.44	36.3
4EMI2F	1.21E+03	5.29	28.53 28.49	1.73E+03 1.77E+03	1.75E+03	4.8	-0.49	32.4
5EMI2F	2.57E+03	5.61	27.31 27.25	4.27E+03 4.44E+03	4.36E+03	5.2	-0.41	38.9
6EMI2F	2.57E+03	5.61	27.14 27.15	4.78E+03 4.75E+03	4.77E+03	5.23	-0.38	41.7
7EMI2F	2.99E+03	5.68	26.19 26.14	8.28E+03 8.54E+03	8.41E+03	5.48	-0.2	63.1
8EMI2F	2.99E+03	5.68	26.03 26.04	9.24E+03 9.16E+03	9.20E+03	5.52	-0.16	69.2
9EMI2F	4.43E+03	5.85	26.12 26.03	1.13E+04 1.20E+03	1.17E+04	5.62	-0.23	58.9
10EMI2F	4.43E+03	5.85	26.06 26.09	1.18E+04 1.16E+04	1.17E+04	5.62	-0.23	58.9

Rendement moyen pour le niveau 100 000 UG/L: **-0.36** | **46.2**

Rendement moyen Eau minérale FDRS Short Protocol: **-0.33** | **49.4**

Robustesse Tour aéroréfrigérante



Echantillon	Valeur de dopage UG/puits	Valeur de dopage A(log)	Résultat analyse C(t)	Résultat analyse UG/puits	Résultat analyse Moyenne UG/puits	Résultat analyse B(log)	Rendement log	Rendement %
1TAR1	2.38E+01	3.58	34.27	3.82E+01				
			34.24	3.89E+01	3.86E+01	3.09	-0.49	32.4
2TAR1	2.38E+01	3.58	33.81	5.19E+01				
			33.75	5.38E+01	5.28E+01	3.23	-0.35	44.7
3TAR1	2.43E+01	3.59	34.43	3.48E+01				
			34.73	2.85E+01	3.16E+01	3.01	-0.58	26.3
4TAR1	2.43E+01	3.59	33.56	6.15E+01				
			33.49	6.44E+01	6.30E+01	3.3	-0.29	51.3
5TAR1	2.84E+01	3.66	32.91	9.28E+01				
			32.8	1.00E+02	9.65E+01	3.49	-0.17	67.6
6TAR1	2.84E+01	3.66	32.95	9.03E+01				
			32.61	1.14E+02	1.02E+02	3.51	-0.15	70.8
7TAR1	4.56E+01	3.86	32.53	1.18E+02				
			32.43	1.26E+02	1.22E+02	3.59	-0.27	53.7
8TAR1	4.56E+01	3.86	32.29	1.38E+02				
			32.5	1.20E+02	1.29E+02	3.62	-0.24	57.5
9TAR1	4.97E+01	3.9	33.05	9.57E+01				
			32.95	1.02E+02	9.89E+01	3.5	-0.4	39.8
10TAR1	4.97E+01	3.9	32.69	1.22E+02				
			32.67	1.24E+02	1.23E+02	3.6	-0.3	50.1
Aquadien Short Protocol			Rendement moyen pour le niveau 1 000 UG/L				-0.32	49.4

Echantillon	Valeur de dopage UG/puits	Valeur de dopage A(log)	Résultat analyse C(t)	Résultat analyse UG/puits	Résultat analyse Moyenne UG/puits	Résultat analyse B(log)	Rendement log	Rendement %
1TAR2	2.17E+03	5.54	27.2	4.09E+03				
			27.21	4.08E+03	4.08E+03	5.11	-0.43	37.2
2TAR2	2.17E+03	5.54	27.39	3.61E+03				
			27.4	3.58E+03	3.60E+03	5.06	-0.48	33.1
3TAR2	1.21E+03	5.29	27.77	2.84E+03				
			27.87	2.67E+03	2.76E+03	4.95	-0.34	45.7
4TAR2	1.21E+03	5.29	28.3	2.01E+03				
			28.3	2.01E+03	2.01E+03	4.81	-0.48	33.1
5TAR2	2.57E+03	5.61	26.46	7.61E+03				
			26.38	8.07E+03	7.84E+03	5.4	-0.21	61.7
6TAR2	2.57E+03	5.61	26.61	6.90E+03				
			26.75	6.23E+03	6.56E+03	5.32	-0.29	51.3
7TAR2	2.99E+03	5.68	25.98	9.53E+03				
			25.92	9.93E+03	9.73E+03	5.49	-0.19	64.6
8TAR2	2.99E+03	5.68	25.98	9.56E+03				
			25.91	9.56E+03	9.78E+03	5.5	-0.18	66.1
9TAR2	4.43E+03	5.85	26.31	9.89E+03				
			26.26	1.02E+04	1.01E+04	5.51	-0.34	45.7
10TAR2	4.43E+03	5.85	26.26	1.03E+04				
			26.29	1.00E+04	1.01E+04	5.51	-0.34	45.7
Rendement moyen Tour aéroréfrigérante Aquadien Short Protocol			Rendement moyen pour le niveau 100 000 UG/L				-0.33	48.4
							-0.33	48.9

Echantillon	Valeur de dopage UG/puits	Valeur de dopage A(log)	Résultat analyse C(t)	Résultat analyse UG/puits	Résultat analyse Moyenne UG/puits	Résultat analyse B(log)	Rendement log	Rendement %
1TAR1W	4.97E+01	3.9	33.01	9.86E+01				
			32.7	1.22E+02	1.10E+02	3.6	-0.3	50.1
2TAR1W	4.97E+01	3.9	33.08	9.37E+01				
			33	9.90E+01	9.63E+01	3.54	-0.33	46.8
3TAR1W	3.32E+01	3.73	32.83	8.10E+01				
			32.32	1.18E+02	9.95E+01	3.55	-0.18	66.1
4TAR1W	3.32E+01	3.73	33.27	5.86E+01				
			33.14	6.44E+01	6.15E+01	3.34	-0.39	40.7
5TAR1W	4.84E+01	3.89	33.14	1.11E+02				
			32.56	1.61E+02	1.36E+02	3.69	-0.2	63.1
6TAR1W	4.84E+01	3.89	33.11	1.14E+02				
			33.25	1.04E+02	1.09E+02	3.59	-0.3	50.1
7TAR1W	4.43E+01	3.85	33.14	6.99E+01				
			32.82	8.72E+01	7.85E+01	3.45	-0.4	39.8
8TAR1W	4.43E+01	3.85	32.45	1.12E+02				
			32.45	1.12E+02	1.12E+02	3.61	-0.24	57.5
9TAR1W	3.52E+01	3.75	32.08	1.32E+02				
			31.88	1.51E+02	1.42E+02	3.71	-0.04	91.2
10TAR1W	3.52E+01	3.75	32.08	1.32E+02				
			32.16	1.25E+02	1.29E+02	3.67	-0.08	83.2
W2 Short Protocol			Rendement moyen pour le niveau 1 000 UG/L				-0.25	58.9

Echantillon	Valeur de dopage UG/puits	Valeur de dopage A(log)	Résultat analyse C(t)	Résultat analyse UG/puits	Résultat analyse Moyenne UG/puits	Résultat analyse B(log)	Rendement log	Rendement %
1TAR2W	4.43E+03	5.85	26.67	7.72E+03				
			26.29	1.00E+04	8.87E+03	5.5	-0.35	44.7
2TAR2W	4.43E+03	5.85	26.05	1.19E+04				
			26.06	1.17E+04	1.18E+04	5.63	-0.22	60.3
3TAR2W	4.48E+03	5.86	26.37	9.43E+03				
			26.37	9.44E+03	9.44E+03	5.53	-0.33	46.8
4TAR2W	4.48E+03	5.86	26.08	1.17E+04				
			26.1	1.15E+04	1.16E+04	5.62	-0.24	57.5
5TAR2W	3.63E+03	5.76	26.27	8.60E+03				
			26.27	8.57E+03	8.59E+03	5.49	-0.27	53.7
6TAR2W	3.63E+03	5.76	26.42	7.81E+03				
			26.45	7.65E+03	7.73E+03	5.44	-0.32	47.9
7TAR2W	3.57E+03	5.76	26.56	6.62E+03				
			26.45	7.15E+03	6.89E+03	5.39	-0.37	42.7
8TAR2W	3.57E+03	5.76	26.13	8.93E+03				
			26.16	8.77E+03	8.85E+03	5.5	-0.26	55
9TAR2W	3.96E+03	5.8	26.43	6.51E+03				
			26.45	6.44E+03	6.47E+03	5.37	-0.43	37.2
10TAR2W	3.96E+03	5.8	26.1	8.20E+03				
			26.17	7.80E+03	8.00E+03	5.46	-0.34	45.7
Rendement moyen Tour aéroréfrigérante W2 Short Protocol			Rendement moyen pour le niveau 100 000 UG/L				-0.31	49.2
							-0.28	54.0

Echantillon	Valeur de dopage UG/puits	A(log)	Résultat analyse C(t)	UG/puits	Moyenne UG/puits	B(log)	Rendement log	%
1TAR1F	2.38E+01	3.58	34.55 34.44	3.18E+01 3.41E+01	3.30E+01	3.07	-0.51	30.9
2TAR1F	2.38E+01	3.58	34.14 33.99	4.17E+01 4.59E+01	4.38E+01	3.2	-0.38	41.7
3TAR1F	4.84E+01	3.89	33.49 33.15	8.91E+01 1.11E+02	9.99E+01	3.56	-0.33	46.8
4TAR1F	4.84E+01	3.89	32.7 32.62	1.47E+02 1.55E+02	1.51E+02	3.74	-0.15	70.8
5TAR1F	2.84E+01	3.66	33.18 32.9	7.73E+01 9.34E+01	8.54E+01	3.49	-0.17	67.6
6TAR1F	2.84E+01	3.66	33.7 33.67	5.43E+01 5.52E+01	5.47E+01	3.29	-0.37	42.7
7TAR1F	4.56E+01	3.86	33.32 33.03	6.97E+01 8.45E+01	7.71E+01	3.44	-0.42	38
8TAR1F	4.56E+01	3.86	32.35 32.64	1.33E+02 1.10E+02	1.21E+02	3.64	-0.22	60.3
9TAR1F	4.97E+01	3.9	32.96 32.68	1.02E+02 1.23E+02	1.12E+02	3.61	-0.29	51.3
10TAR1F	4.97E+01	3.9	32.48 32.8	1.41E+02 1.13E+02	1.27E+02	3.66	-0.24	57.5

FDRS Short Protocol

Rendement moyen pour le niveau 1 000 UG/L | **-0.31** | **50.8**

Echantillon	Valeur de dopage UG/puits	A(log)	Résultat analyse C(t)	UG/puits	Moyenne UG/puits	B(log)	Rendement log	%
1TAR2F	2.17E+03	5.54	27.96 28.03	2.48E+03 2.37E+03	2.42E+03	4.94	-0.6	25.1
2TAR2F	2.17E+03	5.54	27.86 27.92	2.65E+03 2.54E+03	2.60E+03	4.97	-0.57	26.9
3TAR2F	3.63E+03	5.76	26.35 26.39	8.19E+03 7.99E+03	8.09E+03	5.46	-0.3	50.1
4TAR2F	3.63E+03	5.76	26.14 26.18	9.33E+03 9.08E+03	9.21E+03	5.52	-0.24	57.5
5TAR2F	2.57E+03	5.61	26.68 26.56	6.55E+03 7.12E+03	6.84E+03	5.39	-0.22	60.3
6TAR2F	2.57E+03	5.61	26.78 26.76	6.12E+03 6.22E+03	6.17E+03	5.35	-0.26	55
7TAR2F	2.99E+03	5.68	26.35 26.24	7.45E+03 8.02E+03	7.73E+03	5.44	-0.24	57.5
8TAR2F	2.99E+03	5.68	26.12 26.25	8.76E+03 7.96E+03	8.31E+03	5.48	-0.2	63.1
9TAR2F	4.43E+03	5.85	26.57 26.7	8.30E+03 7.56E+03	7.93E+03	5.45	-0.4	39.8
10TAR2F	4.43E+03	5.85	26.35 26.42	9.66E+03 9.17E+03	9.42E+03	5.53	-0.32	47.9

Rendement moyen pour le niveau 100 000 UG/L | **-0.34** | **48.3**

Rendement moyen Tour aéroréfrigérante FDRS Short Protocol | **-0.32** | **49.5**

Appendix 6: Selectivity

Results from iQ-Check™ Quanti L. pneumophila – Extension 2011 - v01 achieved IPL santé, environnement durables Nord

Sélectivité

Souches cibles : *Legionella pneumophila*

	Souche	Origine	Taux cible inoculum (Eq UG/puits)	IQ Check Legionella spp		
				Ct (moy)	UG/puits	Détection *Legionella pneumophila*
1	*L. pneumophila ser 1*	CIP 103854T	1,00E+02	33,17	122	Détecté
2	*L. pneumophila ser 2*	CHUL LG 1007 3002	1,00E+02	33,32	135	Détecté
3	*L. pneumophila ser 3*	CHUL LG 1016 2014	1,00E+02	32,94	122	Détecté
4	*L. pneumophila ser 4*	CHUL LG 1006 3010	1,00E+02	33,31	120	Détecté
5	*L. pneumophila ser 5*	CHUL LG 1008 5013	1,00E+02	33,38	98	Détecté
6	*L. pneumophila ser 6*	ATCC 33215	1,00E+02	33,13	116	Détecté
7	*L. pneumophila ser 7*	CHUL LG 1022 1105	1,00E+02	33,12	122	Détecté
8	*L. pneumophila ser 8*	CHUL LG 1009 3009	1,00E+02	32,95	111	Détecté
9	*L. pneumophila ser 9*	CHUL LG 0925 4012	1,00E+02	33,51	143	Détecté
10	*L. pneumophila ser 10*	CHUL LG 1009 2018	1,00E+02	33,02	113	Détecté
11	*L. pneumophila ser 11*	CHUL LG 0841 3021	1,00E+02	33,20	106	Détecté
12	*L. pneumophila ser 12*	CHUL LG 1009 3041	1,00E+02	33,20	126	Détecté
13	*L. pneumophila ser 13*	CHUL LG 1022 1006	1,00E+02	33,54	127	Détecté
14	*L. pneumophila ser 14*	CHUL LG 0916 4027	1,00E+02	33,26	143	Détecté
15	*L. pneumophila ser 15*	CHUL LG 0312 4049	1,00E+02	33,18	98	Détecté

Exclusivité

	Souche	Origine	Taux cible inoculum (Eq UG/puits)	IQ Check Legionella pneumophila	
				Ct (moy)	Détection
1	*Legionella anisa*	CIP 103870	1,00E+04	N/A	Non détecté
2	*Legionella bozemanii*	CIP 103872 (éq ATCC 33217)[a]	1,00E+04	N/A	Non détecté
3	*Legionella dunmofii*	CIP 103876 (éq ATCC 33279)[b]	1,00E+04	N/A	Non détecté
4	*Legionella gormanii*	ATCC 33297	1,00E+04	N/A	Non détecté
5	*Legionella jordanis*	ATCC 33623 (éq CIP 105268)	1,00E+04	N/A	Non détecté
6	*Legionella longbeachae*	ATCC 33462 (éq CIP 103880)	1,00E+04	N/A	Non détecté
7	*Legionella micdadei*	CIP 103882 (éq ATCC 33218)[c]	1,00E+04	N/A	Non détecté
8	*Legionella parisiensis*	NCTC 11983 (éq CIP 103847)	1,00E+04	N/A	Non détecté
9	*Legionella tucsonensis*	CHUL LG 08495014	1,00E+04	N/A	Non détecté
10	*Aeromonas hydrophila*	Environnement	1,00E+04	N/A	Non détecté
11	*Alcaligenes faecalis*	CIP 60.80	1,00E+04	N/A	Non détecté
12	*Bacillus subtilis*	CCM 1999	1,00E+04	N/A	Non détecté
13	*Burkholderia cepacia*	Eau de douche, La chapelle St Mesnin	1,00E+04	N/A	Non détecté
14	*Clostridium*	Eau de puits, Boghni	1,00E+04	N/A	Non détecté
15	*Enterobacter aerogenes*	Environnement	1,00E+04	N/A	Non détecté
16	*Escherichia coli*	Eau d'alimentation, Liencourt	1,00E+04	N/A	Non détecté
17	*Flavobacterium*	Environnement	1,00E+04	N/A	Non détecté
18	*Klebsiella oxytoca*	ATCC 49473	1,00E+04	N/A	Non détecté
19	*Listeria monocytogenes*	CCM 5576	1,00E+04	N/A	Non détecté
20	*Proteus vulgaris*	Environnement	1,00E+04	N/A	Non détecté
21	Pseudomonas aeruginosa	Eau d'alimentation, Lille	1,00E+04	N/A	Non détecté
22	Pseudomonas fluorescens	Environnement	1,00E+04	N/A	Non détecté
23	Pseudomonas putida	Environnement	1,00E+04	N/A	Non détecté
24	Serratia marcescens	Environnement	1,00E+04	N/A	Non détecté
25	Stenotrophomonas maltophila	Canal de la Deûle, Lille	1,00E+04	N/A	Non détecté

[a]Fluoribacter bozemanae
[b]Fluoribacter dumofii
[c]Tatlockia micdade