



inc. BIOLOGICAL CONSULTING SERVICES
OF NORTH FLORIDA, INC.

April 28, 2016

Icon Lifesaver Ltd.
Hall Chase, London Road
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RE: Biological filtration efficacy test study of the provided Icon Lifesaver® C2 filter unit equipped with filter cartridges C2P_0001 and C2P_0002; BCS IDs 1604207 and 1604208 respectively.

To whom it may concern,

We have conducted the requested filtration efficacy study on the filter unit received on April 21st, 2016. The experimental set up and challenge of the water filters was designed to evaluate the filters microbiological contaminant removal efficacy. The contaminant species and water parameters selected were based on client's request and guidance from NSF/ANSI P231 water purifier test protocol. The units' challenge parameters were selected to simulate operation of the filter unit by personnel.

In the following pages, you will find a summary of the methodology used and the results of our analysis. Should you have any questions or concerns, please do not hesitate to contact me.

Best Regards,

George Lukasik, Ph.D.
Laboratory Director

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FL DOH #E82924, ISO/IEC 17025:2005 L2422 (L-A-B), EPA# FLO1147

FILE: ICON LIFESAVER C2 FILTER TESTING BCS 1604207-208 04.28.2016

THIS REPORT SHALL NOT BE REPRODUCED, EXCEPT IN FULL, WITHOUT THE WRITTEN CONSENT OF BCS LABORATORIES



Project: Icon LIFESAVER® C2 Efficacy Test
Sample(s): BCS 1604207 and 1604208 received April 21st, 2016
Test: Filtration Efficacy – General Test Water Type 1 (GTW1)
Test Parameter: *Raoultella terrigena* (Bacteria)
Test Date: April 25th, 2016

Challenge Species	Volume (Liters) passed through the unit	Filter influent average concentration	Average bacteria concentration (cfu/mL) in the filters' effluents at the indicated volume**	
			C2P_0001 BCS 1604207	C2P_0002 BCS 1604208
Bacteria: <i>Raoultella terrigena</i> ¹	50	4.3 x 10 ⁵ cfu/mL	< 0.25 cfu/mL* >99.99994%***	< 0.25 cfu/mL* >99.99994%***
	100		< 0.25 cfu/mL* >99.99994%***	< 0.25 cfu/mL* >99.99994%***
	200		< 0.25 cfu/mL* >99.99994%***	< 0.25 cfu/mL* >99.99994%***
	400		< 0.25 cfu/mL* >99.99994%***	< 0.25 cfu/mL* >99.99994%***

¹ *Raoultella terrigena* (ATCC 33257) was obtained from ATCC and propagated on Tryptic Soy Agar (TSA, Becton Dickinson, USA). It is used to evaluate filters' bacterial removal efficacy. Bacteria was enumerated as colony forming units (cfu) following incubation at 36.5°C for 24 hours as per Standard method 9215C (APHA, 2012).

* No species were detected in the filter effluent for the total volume analyzed. Filter effluent samples were analyzed in duplicates at the minimum following collection.

** Provided filters were subjected to the challenge study as described in the methods section. Collected samples of filter units' influent and effluent were assayed for the respective challenge species as per Standard Methods and Lab Standard Operating Procedures. The respective percent reductions were determined based on the species' concentration obtained in the filter influent and effluent samples.

*** Purifier NSF/ANSI standard microbial removal claims are 99.9999% or greater for bacteria, 99.99% or greater for virus, and 99.9% or greater for parasite cysts.

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Project: Icon LIFESAVER® C2 Efficacy Test
Sample(s): BCS 1604207 and 1604208 received April 21st, 2016
Test: Filtration Efficacy – General Test Water Type 1 (GTW1)
Test Parameter: MS-2 Bacteriophage (virus)
Test Date: April 25th, 2016

Challenge Species	Volume (Liters) passed through the unit	Filter influent average concentration	Average virus concentration (pfu/mL) in the filters' effluents at the indicated volume**	
			C2P_0001 BCS 1604207	C2P_0002 BCS 1604208
Virus: MS-2 Bacteriophage ²	50	3.3 x 10 ⁵ cfu/mL	3.4 pfu/mL 99.999%***	1.8 pfu/mL 99.9995%***
	100		2.5 pfu/mL 99.9992%***	3.2 pfu/mL 99.999%***
	200		3.2 pfu/mL 99.999%***	4.5 pfu/mL 99.999%***
	400		3.9 pfu/mL 99.999%***	4.5 pfu/mL 99.999%***

²Bacteriophage MS-2 (ATCC 15597-B1) was used as a model for human viruses. It is of similar shape and size to human enteroviruses and thus is used to determine filter's viral capture efficacy.

** Provided filters were subjected to the challenge study as described in the methods section. Collected samples of filter units' influent and effluent were assayed for the respective challenge species as per Standard Methods and Lab Standard Operating Procedures. The respective percent reductions were determined based on the species' concentration obtained in the filter influent and effluent samples.

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Project: Icon LIFESAVER® C2 Efficacy Test
Sample(s): BCS 1604207 and 1604208 received April 21st, 2016
Test: Filtration Efficacy – General Test Water Type 1 (GTW1)
Test Parameter: 3.0 µM Fluorescent Microspheres as *Cryptosporidium parvum* oocyst surrogate
Test Date: April 25th, 2016

Challenge Species	Volume (Liters) passed through the unit	Filter influent average concentration	Average concentration (Microspheres/mL) in the filters' effluents at the indicated volume**	
			C2P_0001 BCS 1604207	C2P_0002 BCS 1604208
3.0 µM Fluorescent microspheres ³	50	4.5 x 10 ⁴ particle/mL	< 1.0 particle/mL* >99.999%***	< 1.0 particle/mL* >99.999%***
	100		< 1.0 particle/mL* >99.999%***	< 1.0 particle/mL* >99.999%***
	200		< 1.0 particle/mL* >99.999%***	< 1.0 particle/mL* >99.999%***
	400		< 1.0 particle/mL* >99.999%***	< 1.0 particle/mL* >99.999%***

³Three micron green fluorescent latex microspheres (Fluoro-Max™ Green Fluorescent Microspheres 3.00µm, Thermo Scientific CA, USA) were used as surrogates for *Cryptosporidium* oocysts. It is used to determine filter's parasitic removal efficacy. The microspheres were enumerated by fixing onto 3-Well PTFE Slides (Electron Microscopy Sciences, USA) and viewing by UV fluorescence microscopy.

* No species were detected in the filter effluent for the total volume analyzed. Filter effluent samples were analyzed in duplicates at the minimum following collection.

** Provided filters were subjected to the challenge study as described in the methods section. Collected samples of filter units' influent and effluent were assayed for the respective challenge species as per Standard Methods and Lab Standard Operating Procedures. The respective percent reductions were determined based on the species' concentration obtained in the filter influent and effluent samples.

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Project: Icon LIFESAVER® C2 Efficacy Test
Sample(s): BCS 1604207 and 1604208 received April 21st, 2016
Test: Filtration Efficacy – Challenge Test Water Type 3 (CTW3)
Test Parameter: *Raoultella terrigena* (Bacteria)
Test Date: April 25th, 2016

Challenge Species	Volume (Liters) passed through the unit	Filter influent average concentration	Average bacteria concentration (cfu/mL) in the filters' effluents at the indicated volume**	
			C2P_0001 BCS 1604207	C2P_0002 BCS 1604208
Bacteria: <i>Raoultella terrigena</i> ¹	50	3.5 x 10 ⁵ cfu/mL	< 0.25 cfu/mL* >99.99993%***	< 0.25 cfu/mL* >99.99993%***
	100		< 0.25 cfu/mL* >99.99993%***	< 0.25 cfu/mL* >99.99993%***
	200		< 0.25 cfu/mL* >99.99993%***	< 0.25 cfu/mL* >99.99993%***
	400		< 0.25 cfu/mL* >99.99993%***	< 0.25 cfu/mL* >99.99993%***

¹ *Raoultella terrigena* (ATCC 33257) was obtained from ATCC and propagated on Tryptic Soy Agar (TSA, Becton Dickinson, USA). It is used to evaluate filters' bacterial removal efficacy. Bacteria was enumerated as colony forming units (cfu) following incubation at 36.5°C for 24 hours as per Standard method 9215C (APHA, 2012).

* No species were detected in the filter effluent for the total volume analyzed. Filter effluent samples were analyzed in duplicates at the minimum following collection.

** Provided filters were subjected to the challenge study as described in the methods section. Collected samples of filter units' influent and effluent were assayed for the respective challenge species as per Standard Methods and Lab Standard Operating Procedures. The respective percent reductions were determined based on the species' concentration obtained in the filter influent and effluent samples.

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Project: Icon LIFESAVER® C2 Efficacy Test
Sample(s): BCS 1604207 and 1604208 received April 21st, 2016
Test: Filtration Efficacy – Challenge Test Water Type 3 (CTW3)
Test Parameter: MS-2 Bacteriophage (virus)
Test Date: April 25th, 2016

Challenge Species	Volume (Liters) passed through the unit	Filter influent average concentration	Average virus concentration (pfu/mL) in the filters' effluents at the indicated volume**	
			C2P_0001 BCS 1604207	C2P_0002 BCS 1604208
Virus: MS-2 Bacteriophage ²	50	3.3 x 10 ⁵ cfu/mL	14.7 pfu/mL 99.996%***	15.7 pfu/mL 99.995%***
	100		14.7 pfu/mL 99.996%***	14.1 pfu/mL 99.996%***
	200		11.8 pfu/mL 99.996%***	16.4 pfu/mL 99.995%***
	400		15.9 pfu/mL 99.996%***	17.7 pfu/mL 99.994%***

²Bacteriophage MS-2 (ATCC 15597-B1) was used as a model for human viruses. It is of similar shape and size to human enteroviruses and thus is used to determine filter's viral capture efficacy.

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Project: Icon LIFESAVER® C2 Efficacy Test
Sample(s): BCS 1604207 and 1604208 received April 21st, 2016
Test: Filtration Efficacy – Challenge Test WaterType 3 (CTW3)
Test Parameter: 3.0 µM Fluorescent Microspheres as *Cryptosporidium parvum* oocyst surrogate
Test Date: April 25th, 2016

Challenge Species	Volume (Liters) passed through the unit	Filter influent average concentration	Average concentration (Microspheres/mL) in the filters' effluents at the indicated volume**	
			C2P_0001 BCS 1604207	C2P_0002 BCS 1604208
3.0 µM Fluorescent microspheres ³	50	4.5 x 10 ⁴ particle/mL	< 1.0 particle/mL* >99.999%***	< 1.0 particle/mL* >99.999%***
	100		< 1.0 particle/mL* >99.999%***	< 1.0 particle/mL* >99.999%***
	200		< 1.0 particle/mL* >99.999%***	< 1.0 particle/mL* >99.999%***
	400		< 1.0 particle/mL* >99.999%***	< 1.0 particle/mL* >99.999%***

³Three micron green fluorescent latex microspheres (Fluoro-Max™ Green Fluorescent Microspheres 3.00µm, Thermo Scientific CA, USA) were used as surrogates for *Cryptosporidium* oocysts. It is used to determine filter's parasitic removal efficacy. The microspheres were enumerated by fixing onto 3-Well PTFE Slides (Electron Microscopy Sciences, USA) and viewing by UV fluorescence microscopy.

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I hereby certify to the accuracy, quality, and data integrity of the reported study. I also certify that the study was appropriately executed and is fully defensible. All physical measurements and their source have been documented. Measurements were obtained using approved protocols and NIST traceable and/or validated instruments. Analysis execution and results were fully documented. Analytical methods used to produce the study's raw data are within the laboratory's ISO 17025 accreditation. The results and conclusions of the study accurately reflect the real raw data obtained in the study.

Signature of Sr. Analyst



David Sekora, M.S.

Date: 04/28/2016



George Lukasik, Ph.D.

Date: 04/28/2016

I certify that I have personally examined and am familiar with the information submitted herein. Based on my inquiry of the individuals immediately responsible for obtaining the information, I certify the submitted information to be true, accurate, and complete. The data provided is solely representative of the analysis conducted on the material/samples/articles provided by the client (or client's representative) it's (their) condition at the time of study. They may not be representative of a process or product. The sample(s) were analyzed in accordance with the method described for each analyte. Due to the inherent limitation(s) of analytical method(s), BCS Laboratories offers no express or implied warranties concerning the quality, safety, and/or purity of any sample, batch, source, or the process they are derived from. The species analysis and corresponding presented results in this report meet the requirements of The NELAC Institute (TNI), ISO 17025, and The State of Florida Department of Public Health's Laboratory Certification Program, as applicable unless otherwise noted.

Signature of Study Director



George Lukasik, Ph.D.

Date: 02/28/2016

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