



Biological Consulting Services

Of North Florida, Inc.

2023-11-30

Membrane Solutions
3320 W Valley Hwy North; D108
Auburn WA 98001

Client ID: PERSONAL WATER FILTER 1, PERSONAL WATER FILTER 2; M01015

Information provided by sponsor following start of study:

Brand: American Red Cross
Product name: Personal Water Filter
SKU: FLTR-ARC-4S-R
UPC:810080493971

BCS ID: 2311206, 2311207

Project Name: Membrane Solutions 11172023 *Escherichia coli* and *Cryptosporidium parvum* Initial Filtration Efficacy Testing

Dear Project Manager,

We have completed the filtration efficacy study on the submitted units as outlined below. The contaminant species, study conditions, and water parameters utilized were based on client's request and adaptation of the guidance documents and protocols listed below:

Water Purifier Efficacy: Validation of water purifier microbiological filtration efficacy: Initial Microbial Filtration Performance; BCS SOP-F1 (ISO17025-2017 accredited).

Following, you will find our report on the results of the study conducted on the referenced samples. Should you have any questions, please do not hesitate to contact me.

Sincerely,

George Lukasik, Ph.D.
Laboratory Director

Page 1 of 9

Final Report BCS ID 2311206, 2311207 Revision #0: JN 11/21/2023

Client: Membrane Solutions

Project: Membrane Solutions 11172023 *Escherichia coli* and *Cryptosporidium parvum* Initial Efficacy Testing

BCS LABORATORIES, INC. — GAINESVILLE
4609 NW 6TH STREET, STE. A, GAINESVILLE, FLORIDA 32609
TEL. (352) 377-9272, FAX. (352) 377-5630

WWW.MICROBIOSERVICES.COM

FL DOH E82924, ISO 17025:2017 L2422 (ANAB), PA DEP 68-03950, EPA FLO1147

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



Analysis: *E. coli* (ATCC 25922) Filtration Efficacy

Test Water: Challenge Test Water

Analysis Method: Spread Plating (Standard Method 9215)

Test Point: Initial Efficacy (4 liters)

Challenge Date: 2023-11-20 Challenge Analysts: Jonathon Nunes

Initial Pres. (PSI): -1.24 Temp(C): 21.2

pH: 7.75 Turbidity (NTU): 0.54 TOC (ppm): 1.12 TDS(ppm): 224 Hardness(ppm): N/A

Alkalinity(ppm): N/A Total Chlorine(ppm): <0.01 Polyphosphate (as ppm phosphorus): N/A

Influent Conc: 1.3E+06 cfu/mL Ambient Temp(C): 21.3

Analysis Date: 2023-11-20 Analysts: Jonathon Nunes

Test Notes: Challenge conducted and results are presented below.

BCS Sample ID 1: 2311206	Client ID 1: FILTER 1	Flow Rate: 800 mL/min	
Eff Conc 1: <3.0E-01 cfu/mL	% Reduct 1: >99.99998	Log10 Reduct 1: >6.6	
BCS Sample ID 2: 2311207	Client ID 2: FILTER 2	Flow Rate: 800 mL/min	
Eff Conc 2: <3.0E-01 cfu/mL	% Reduct 2: >99.99998	Log10 Reduct 2: >6.6	

Client: Membrane Solutions

Project: Membrane Solutions 11172023 Escherichia coli and Cryptosporidium parvum Initial Filtration Efficacy Testing

BCS LABORATORIES, INC. — GAINESVILLE
4609 NW 6TH STREET, STE. A, GAINESVILLE, FLORIDA 32609
TEL. (352) 377-9272, FAX. (352) 377-5630

WWW.MICROBIOSERVICES.COM

FL DOH E82924, ISO 17025:2017 L2422 (ANAB), PA DEP 68-03950, EPA FLO1147

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



Analysis: *Cryptosporidium Parvum* (Cyst)

Test Water: Challenge Test Water

Analysis Method: Fluorescent Microscopic Enumeration (EPA 1623.1)

Test Point: Initial Efficacy (4 liters)

Challenge Date: 2023-11-20 Challenge Analysts: Jonathon Nunes

Initial Pres. (PSI): -1.24 Temp(C): 21.2

pH: 7.75 Turbidity (NTU): 0.54 TOC (ppm): 1.12 TDS(ppm): 224 Hardness(ppm): N/A

Alkalinity(ppm): N/A Total Chlorine(ppm): <0.01 Polyphosphate (as ppm phosphorus): N/A

Influent Conc: 3.5E+04 Cysts/mL Ambient Temp(C): 21.3

Analysis Date: 2023-11-20 Analysts: Jonathon Nunes

Test Notes: Challenge conducted and results are presented below.

BCS Sample ID 1: 2311206	Client ID 1: FILTER 1	Flow Rate: 800 mL/min	
Eff Conc 1: <6.7E-01 microspheres/mL	% Reduct 1: >99.998	Log10 Reduct 1: >4.7	
BCS Sample ID 2: 2311207	Client ID 2: FILTER 2	Flow Rate: 800 mL/min	
Eff Conc 2: <6.7E-01 microspheres/mL	% Reduct 2: >99.998	Log10 Reduct 2: >4.7	

Client: Membrane Solutions

Project: Membrane Solutions 11172023 Escherichia coli and Cryptosporidium parvum Initial Filtration Efficacy Testing

BCS LABORATORIES, INC. — GAINESVILLE
4609 NW 6TH STREET, STE. A, GAINESVILLE, FLORIDA 32609
TEL. (352) 377-9272, FAX. (352) 377-5630

WWW.MICROBIOSERVICES.COM

FL DOH E82924, ISO 17025:2017 L2422 (ANAB), PA DEP 68-03950, EPA FLO1147

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



Project: Membrane Solutions 11172023 Escherichia coli and Cryptosporidium parvum Initial Filtration Efficacy Testing

Date Received: 2023-11-17 12:31

Test Start Date: 2023-11-20

Test End Date: 2023-11-21

System Type: Mouth Drawn Purifier Unit

Est. Capacity: N/A

Performance Indicating Device: N/A

Batch Volume: N/A

Batch, number per day: N/A

Test Cycle (min): 3

Cycle On/Off (%): 50/50

Restricted Flow Rate: Yes

Test Duration (hr/day): 16

Test Conditioning: Flushed for one minute

Report Notes:

The purifier units were received from the study sponsor, and each was assigned the referenced BCS identifiers. As per client request, only the initial filtration efficacy was evaluated. The test set-up was based on methodology described in NSF/ANSI 53 Annex 3: test method for evaluating mouth drawn water treatment units. The microbial challenge procedure and reduction requirement in protocol NSF/ANSI P231 were utilized in the study. The vacuum was measured continuously and did not fall below -3.0 PSI. The units were conditioned by passing General Test Water (GTW as per NSF/ANSI P231; dechlorinated municipal water) through each filter unit for 1 minute. Following the conditioning step, each unit was tested for initial bacterial and Cryptosporidium cyst (as microsphere) reduction efficacy as per laboratory protocol. Aliquots of the challenge species were added to 10 L of the prepared Challenge Test Water, and the water was homogenized. 4-Liter of challenge water was aspirated through each of the water purifiers at the indicated flow rates. Following, aliquots of each unit's effluent was then collected for analysis. Collected influent and effluent samples' analysis was conducted as per laboratory's accredited ISO17025:2017 methodology: bacteria as per SM 9215 (APHA 2012; LOD: 1 cfu/unit volume analyzed), Cryptosporidium as per method EPA1623.1 (LOD 1 Cyst/unit volume analyzed), turbidity was determined as per SM2130B (LOD: 0.01 NTU), pH as per SM4500HB (LOD: 0.01), TDS as per SM2540 (LOD: 0.1 ppm), chlorine as per SM4500-Cl G (LOD: 0.01 ppm), Total Organic Carbon (TOC) as per SM5310C (LOD: 0.1 ppm). All analysis was conducted using calibrated and/or validated Instruments to traceable standards (NIST). All method QC was within method acceptance limit. No general environmental conditions are specified in the standard or have been identified that could affect the test results or measurements. END OF REPORT NOTES.

Client: Membrane Solutions

Project: Membrane Solutions 11172023 Escherichia coli and Cryptosporidium parvum Initial Filtration Efficacy Testing

BCS LABORATORIES, INC. — GAINESVILLE

4609 NW 6TH STREET, STE. A, GAINESVILLE, FLORIDA 32609

TEL. (352) 377-9272, FAX. (352) 377-5630

WWW.MICROBIOSERVICES.COM

FL DOH E82924, ISO 17025:2017 L2422 (ANAB), PA DEP 68-03950, EPA FLO1147

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



*I certify that I have examined and I am familiar with the information submitted herein. The results pertain only to the sample(s) tested, associated identifier #(s), and condition at receipt. Based on my inquiry of the individuals responsible for the analysis, I believe the data to be true, accurate, and complete. Unit descriptions and names were obtained from the submitted documents. The analysis was authorized and commissioned by the client or client's representative. The resulting data are representative of the analysis conducted on the collected samples and it's/their condition at the time of analysis. The data provided is strictly representative of the study conducted under laboratory conditions using the material/samples/articles provided by the client (or client's representative) and it's (their) condition at the time of test following receipt. The data obtained may not be representative or indicative of a real-life process and/or application. The sample(s) were analyzed in accordance with the appropriate method, however due to the inherent limitations of methods, microorganisms may avoid detection. 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. Quality assurance controls were performed as outlined in the method and as per Good Laboratory Practices. Analyses were performed in accordance with laboratory practices and procedures set-forth by ISO 17025-2017 and NELAP/TNI accreditation standards unless otherwise noted. BCS makes no express or implied warranty regarding the ownership, merchantability, safety or fitness for a particular purpose of any such property or product.

Signature of Laboratory Director/Authorized Rep. _____



Date: 2023-11-21

Client: Membrane Solutions

Project: Membrane Solutions 11172023 Escherichia coli and Cryptosporidium parvum Initial Filtration Efficacy Testing

BCS LABORATORIES, INC. — GAINESVILLE
4609 NW 6TH STREET, STE. A, GAINESVILLE, FLORIDA 32609
TEL. (352) 377-9272, FAX. (352) 377-5630

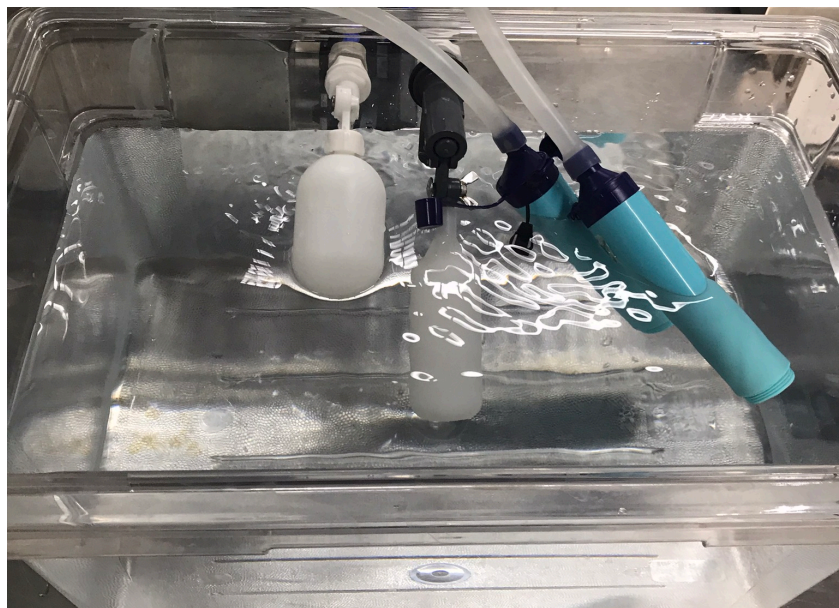
WWW.MICROBIOSERVICES.COM

FL DOH E82924, ISO 17025:2017 L2422 (ANAB), PA DEP 68-03950, EPA FL01147

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



Pictures:



Page 6 of 9

Final Report BCS ID 2311206, 2311207 Revision #0: JN 11/21/2023

Client: Membrane Solutions

Project: Membrane Solutions 11172023 Escherichia coli and Cryptosporidium parvum Initial Filtration Efficacy Testing

BCS LABORATORIES, INC. — GAINESVILLE
4609 NW 6TH STREET, STE. A, GAINESVILLE, FLORIDA 32609
TEL. (352) 377-9272, FAX. (352) 377-5630

WWW.MICROBIOSERVICES.COM

FL DOH E82924, ISO 17025:2017 L2422 (ANAB), PA DEP 68-03950, EPA FL01147

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



*Balance ID: BL-11	Description: Sartorius Practum Precision Balance
Range of Function: 0.001-220.000	Instrument Reporting Limit: 0.001
Last Service Date: 2023-08-25	Service Due Date: 2024-08-25
Service Type: NIST Calibration	NIST Validation Instrument: External Provider
*pH Meter ID: Ph-10	Description: Orion Versa Star Pro Meter w/pH and Conductivity Modules
Range of Function: 0.001-12.000	Instrument Reporting Limit: 0.001
Last Service Date: 2023-11-20	Service Due Date: 2023-11-21
Service Type: Validation to NIST	NIST Validation Instrument: NIST Standard Solutions
*Conductivity Meter ID: CM-10	Description: Orion Versa Star Pro Meter w/pH and Conductivity Modules
Range of Function: 0.01-2400 ppm	Instrument Reporting Limit: N/A
Last Service Date: 2023-11-20	Service Due Date: 2023-11-21
Service Type: Validation to NIST	NIST Validation Instrument: NIST Standard Solutions
*Alkalinity Meter ID: N/A	Description:
Range of Function:	Instrument Reporting Limit:
Last Service Date:	Service Due Date:
Service Type:	NIST Validation Instrument:
*Hardness Meter ID: N/A	Description:
Range of Function:	Instrument Reporting Limit:
Last Service Date:	Service Due Date:
Service Type:	NIST Validation Instrument:
*Turbidity Meter ID: TM-06	Description: Hach Turbidimeter
Range of Function: 0 to 4000 NTU	Instrument Reporting Limit: 0.01NTU
Last Service Date: 2022-12-13	Service Due Date: 2023-12-13
Service Type: Yearly Service	NIST Validation Instrument: NIST Standard Solutions
*Spectrophotometer ID: COL-03	Description: Hach Colorimeter DR 890
Range of Function: N/A	Instrument Reporting Limit: 0.01nm
Last Service Date: 2022-12-13	Service Due Date: 2023-12-13
Service Type: Hach	NIST Validation Instrument: NIST
Incubator ID: I-20	Description: Thermo Fisher Forma 29 cu. ft. Reach-In Incubator
Range of Function: 10-65C	Instrument Reporting Limit: 0.1C
Last Service Date: 2023-09-01	Service Due Date: 2024-09-30
Service Type: Annual Service	NIST Validation Instrument: Reference Std./Instrument

Client: Membrane Solutions

Project: Membrane Solutions 11172023 Escherichia coli and Cryptosporidium parvum Initial Filtration Efficacy Testing

BCS LABORATORIES, INC. — GAINESVILLE
4609 NW 6TH STREET, STE. A, GAINESVILLE, FLORIDA 32609
TEL. (352) 377-9272, FAX. (352) 377-5630

WWW.MICROBIOSERVICES.COM

FL DOH E82924, ISO 17025:2017 L2422 (ANAB), PA DEP 68-03950, EPA FLO1147

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



**Flow Meter ID 1: FM-212		Description: Blue White Industries Flow Meter
Range of Function:	.025 to .250 GPM	Instrument Reporting Limit: N/A
Last Service Date:	2023-11-20	Service Due Date: 2023-11-21
Service Type:	N/A	NIST Validation Instrument: N/A
**Flow Meter ID 2: N/A		Description:
Range of Function:		Instrument Reporting Limit:
Last Service Date:		Service Due Date:
Service Type:		NIST Validation Instrument:
**Flow Meter ID 3: N/A		Description:
Range of Function:		Instrument Reporting Limit:
Last Service Date:		Service Due Date:
Service Type:		NIST Validation Instrument:
Microscope ID: MIC-03		Description: Olympus BH-2 Microscope
Range of Function:	40X-400X Magnification	Instrument Reporting Limit: 0.5 micron
Last Service Date:	2023-09-18	Service Due Date: 2024-09-18
Service Type:	Annual Service	NIST Validation Instrument: NIST Micrometer
Refrigerator ID: FR-11		Description: Migali B Series Glass Door Refrigerator
Range of Function:	1-8C	Instrument Reporting Limit: N/A
Last Service Date:	2023-09-01	Service Due Date: 2024-09-30
Service Type:	Annual Service	NIST Validation Instrument: Reference Std./Instrument
Centrifuge ID: C-12		Description: Eppendorf centrifuge w/ cell culture package
Range of Function:	0-4400 RPM	Instrument Reporting Limit: 1 RPM
Last Service Date:	2023-09-01	Service Due Date: 2024-09-30
Service Type:	Annual Service	NIST Validation Instrument: TA-01
Pressure Source Pump ID: PUMP-52		Description: Masterflex L/S
Range of Function:	N/A	Instrument Reporting Limit: N/A
Last Service Date:	2017-08-31	Service Due Date: 2018-08-31
Service Type:	Validation to NIST	NIST Validation Instrument: TA-01
Pressure Meter ID: PM-54 NIS		Description: Digital Pressure Transducer 29 PSI
Range of Function:	0.01-29 PSI	Instrument Reporting Limit: 0.01PSI
Last Service Date:	2023-01-04	Service Due Date: 2024-01-04
Service Type:	Validation to NIST	NIST Validation Instrument: PM-60 NIST

Client: Membrane Solutions

Project: Membrane Solutions 11172023 Escherichia coli and Cryptosporidium parvum Initial Filtration Efficacy Testing

BCS LABORATORIES, INC. — GAINESVILLE
4609 NW 6TH STREET, STE. A, GAINESVILLE, FLORIDA 32609
TEL. (352) 377-9272, FAX. (352) 377-5630
WWW.MICROBIOSERVICES.COM

FL DOH E82924, ISO 17025:2017 L2422 (ANAB), PA DEP 68-03950, EPA FLO1147
THIS REPORT SHALL NOT BE REPRODUCED, EXCEPT IN FULL, WITHOUT THE WRITTEN CONSENT OF BCS LABORATORIES



Cert. Pressure Meter ID:	PM-59 NIS	Description:	Pressure Transducer 72.5 PSI
Range of Function:	0-72.5 PSI	Instrument Reporting Limit:	0.1 PSI
Last Service Date:	2022-12-07	Service Due Date:	2023-12-07
Service Type:	Annual Cal.	NIST Validation Instrument:	Reference Std.
TOC Analyzer ID:	TOC-01	Description:	GE M5310C Lab TOC Analyzer
Range of Function:	40ppb-50ppm	Instrument Reporting Limit:	0.01ppb
Last Service Date:	2023-04-26	Service Due Date:	2024-04-26
Service Type:	Manufacturer Cal.	NIST Validation Instrument:	NIST Standard Solutions
Spectrograph ID:	N/A	Description:	
Range of Function:		Instrument Reporting Limit:	
Last Service Date:		Service Due Date:	
Service Type:		NIST Validation Instrument:	
Thermometer ID:	IR-13 NIST	Description:	VWR Traceable Infrared Thermometer
Range of Function:	0-150 C	Instrument Reporting Limit:	0.1C
Last Service Date:	2023-08-14	Service Due Date:	2024-08-14
Service Type:	Annual Calibration	NIST Validation Instrument:	Manufacture calibration
Particle Counter ID:	N/A	Description:	
Range of Function:		Instrument Reporting Limit:	
Last Service Date:		Service Due Date:	
Service Type:		NIST Validation Instrument:	
Timer ID:	T-62	Description:	VWR Traceable Lab-top Timer
NIST Expiration Date:	2024-01-19		

*Validated at each day of use using NIST traceable standards. Other major equipment validated quarterly.
 **Validated at each use using traceable volume and time measurements.
**All above equipment with completed fields were used from Test Start Date to Test End Date unless otherwise noted.
 Service Date indicates PM or calibration by accredited service provider. Service Dates reported for latest period. If
 Last Service Date occurs during study duration, please contact us for the previous period's validation information.**

END OF REPORT

Client: Membrane Solutions

Project: Membrane Solutions 11172023 Escherichia coli and Cryptosporidium parvum Initial Filtration Efficacy Testing

BCS LABORATORIES, INC. — GAINESVILLE
 4609 NW 6TH STREET, STE. A, GAINESVILLE, FLORIDA 32609
 TEL. (352) 377-9272, FAX. (352) 377-5630
 WWW.MICROBIOSERVICES.COM

FL DOH E82924, ISO 17025:2017 L2422 (ANAB), PA DEP 68-03950, EPA FLO1147
 THIS REPORT SHALL NOT BE REPRODUCED, EXCEPT IN FULL, WITHOUT THE WRITTEN CONSENT OF BCS LABORATORIES

