

# ***FINAL REPORT -Spectrum Labs Inc.***

## ***DOULTON UNDERCOUNTER DRINKING WATER SYSTEM WITH SINGLE ULTRACARB (CU1200) CERAMIC CANDLE Class 1 and Absolute Particulate Reduction***

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### ***Introduction***

Doulton Water Care has developed a proprietary drinking water treatment system that utilizes a radial flow activated carbon block filter cartridge in conjunction with a ceramic candle to remove specific contaminants from drinking water. This product is designed for long life filtration and is available directly through Doulton Water Care to distributors and retailers of point of use (POU) home water filtration systems.

The use of activated carbon block filter cartridges incorporating proven sorbent technology is becoming more prevalent in the design and development of drinking water treatment devices as manufacturers seek to combine the contaminant reduction capabilities of both organics and heavy metal removal technology. Ceramic filter cartridges are commonly used for the removal of harmful bacteria and cysts. Each technology has been established as an effective means for specific contaminant reduction under defined operating conditions.

Reliable information on contaminant removal capabilities is important in marketing this product to potential distributors and to the general public. Furthermore, several states have now implemented regulations which govern the sale and marketing of residential water treatment systems. Therefore, it is now necessary to have verification of contaminant reduction claims by a state certified independent third-party laboratory, using an approved protocol. Spectrum Labs, Inc. is pleased to provide this laboratory report as the result of an independent evaluation of the Doulton HIF undercounter drinking water treatment system containing an Ultracarb filter cartridge (CU1200) for Class I and absolute particulate reduction.

### ***Experimental Section***

#### ***Selection of Analytes and Spiking levels***

The Doulton HIF undercounter drinking water treatment system containing an Ultracarb filter cartridge was evaluated for Class I particulate reduction in accordance with NSF Standard Number 42, "Drinking Water Treatment Units/Aesthetic Effects." Appendix C, "Particulate Reduction Performance," revised June 1988. Influent challenge waters were prepared by adding a known amount of Powder Technologies, Inc. (PTI) fine test dust to achieve a target spike level of 10(4) particles/mL of 0.5- 1.0 micrometers. Also, a single pass

retention efficiency test was performed to determine a 0.5 and 0.9 absolute micron rating.

Influent and effluent samples were analyzed for both Class I and absolute particulate reduction evaluations using American society for Testing and Materials (ASTM) Method Number 795 which is a standard particle counting method. The corresponding Method Detection Limit (MDL), EPA Maximum Contaminant Level (MCL), and Target Spike Level for this analyte is provided in Table I.

Table 1

<b>Analyte Selection for Contaminant Reduction Studies</b>				
Analyte	ASTM Method	Method Detection Limit	EPA MCL	Target Spike Level
Particulate note:1	F795	N/A	N/A	10(4) particles/ml 0.5-1.0 micron size and 0.5 and 0.9 micron absolute
1: PII Fine Test Dust was used as a surrogate.				

### ***Experimental Design***

The experimental and mechanical system design for the Class I particulate reduction evaluation was based on the test protocol contained in NSF Standard Number 42 and the absolute particulate reduction evaluation was based on ASTM F795. Both designs allow for the uninterrupted testing of two identical units simultaneously.

All influent samples were taken immediately prior to the test units to demonstrate that the mechanical test system had no effect on the water characteristics or on the concentration of the challenge analyte. Pressure gauges and flow meters were installed appropriately to allow documentation of system operation.

Test units were installed, conditioned and operated according to the manufacturer's instructions. Prior to spiking the challenge water, background influent and effluent samples were collected until samples obtained a steady state condition. Samples for the Class I particulate reduction evaluation were collected at the start of the initial cycle, at the start of the fourth cycle and when the unit reaches 75 percent reduction in flow or when the pressure drop across the unit reaches 40 PSIG. Spiked challenge water was passed through each test unit using an operating cycle of 50 percent on, 50 percent off with a 3 minute cycle, 16 hours per day, followed by an 8 hour rest period under pressure. Samples were collected for each test at the beginning of the "on" cycle immediately following the passage of one unit volume. Samples of influent and effluent water from the absolute particulate reduction evaluation were collected within 30 seconds after starting the injection of challenge water.

### ***Particulate Reduction Results***

The results of laboratory analysis for the Class I particulate reduction evaluation are summarized in Table 2. Table 3 summarizes the results for the absolute particulate reduction evaluation. The influent and effluent results for each sample point are tabulated along with the percent reduction. Both units evaluated meet the current NSF acceptance levels of at least 85 percent particulate reduction for a Class I filter rating.

### ***Results from Particulate Reduction Studies for the Doulton Undercounter Drinking Water System with CU1200 Ultracarb***

Table 2			Test Unit 1		Test Unit 2	
Samples	Particle Size Range (microns)	Influent Particles/mL	Effluent Particles/mL	Percent Reduction	Effluent Particles/mL	Percent Reduction
Flush	0.5-1.0	5162	2873		3891	
First Cycle	0.5-1.0	2356900	21863	99.07	14890	99.37
Fourth Cycle	0.5-1.0	2459174	11344	99.54	18242	99.26
75% of Flow	0.5-1.0	4093947	14895	99.64	36640	99.10
Flush	1.0-5.0	2	0		1	
First Cycle	1.0-5.0	377272	384	99.90	667	99.82
Fourth Cycle	1.0-5.0	404628	366	99.91	745	99.82
75% of Flow	1.0-5.0	873981	7766	99.91	3565	99.59

Instrumentation: HIAC/Royco 8000A Counter, LD400 Sensor

Fluid: DI Water

Contaminant: PTI Fine Dust

Initial Flow Rate: Unit 1=0.47 gpm, Unit 2=0.58 gpm

Final Flow Rate: Unit 1=0.13 gpm, Unit 2=0.15 gpm

Gallons Treated: Unit 1=7.6, Unit 2=8.1

***Results from Absolute Particulate Reduction Studies for the Doulton Undercounter Drinking Water System with CU1200 Ultracarb***

Table 3		Test Unit 1		Test Unit 2	
Particle Size Microns	Upstream Particles/mL	Downstream Particles/mL	Percent Efficiency	Downstream Particles/mL	Percent Efficiency
0.5-0.8	584528448	83910	99.9856	61137	99.9895
0.8-0.9	24063648	102	99.9996	120	99.9995
0.9-1.0	19505472	56	99.9997	73	99.9997
1.0-1.5	28473984	16	99.9998	22	99.9998
>2.0	15753024	14	99.9999	19	99.9999

Instrumentation: HIAC/Royco 4200 Counter, LAS 346 Sensor

Fluid: DI Water

Contaminant: PTI Fine Dust

Initial Flow Rate: Unit 1=0.5 gpm, Unit 2=0.43 gpm

***Conclusion***

The [Doulton HIP undercounter drinking water treatment system](#) containing an [Ultracarb filter cartridge](#) was found to be very effective at removing particles from spiked challenge water. Calculated particulate reduction percentages were 99.0 percent or greater in both test units. This substantially exceeds the current NSF International Standard Number 42, Appendix C acceptance level for a Class I particulate reduction claim of a minimum 85 percent removal of particles in the 0.5-1.0 micron size range, however, both units did not meet the absolute claim of 99.9999 percent reduction at the 0.5 and 0.9 micron sizes.