

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

## ***DOULTON UNDERCOUNTER DRINKING WATER SYSTEM WITH SINGLE ULTRACARB (CU1200) CERAMIC CANDLE Chlorine 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 chlorine 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 chlorine reduction in accordance with test protocol contained in NSF International Standard Number 42. "Drinking Water Treatment Units/Aesthetic Effects." Appendix B, "Chemical Unit Test Methods." Section I, "Procedure - Plumbed-In Units and Faucet Mounted Taste, Odor and Chlorine Reduction Units

Without Reservoir," revised June 1988. Influent challenge waters for the chlorine reduction evaluation were prepared with an influent free available chlorine (FAC) target spike level of 2.0 mg/L (2.0 ppm).

Influent and effluent samples were analyzed for chlorine using Standard Method for the Examination of Water and Wastewater, 18th Edition, Method Number 4500CL F which is a DPD titration method. The corresponding Method Detection Limit (MDL) and Target Spike Level for this analyte are provided in Table 1.

### *Analyte Selection for Contaminant Reduction Studies*

Analyte	Standard Method	Method Detection Limit (mg/L)	EPA MCL Level (mg/L)	Target Spike Level (mg/L)
Chlorine	4500CL F	0.01	N/A	2.0

### *Experimental Design*

The experimental and mechanical system design for the chlorine reduction evaluation was based on test protocol contained in NSF Standard Number 42. This design allows for the uninterrupted testing of two identical units simultaneously. A mechanical test system plumbed entirely of Teflon was used for this experiment. The use of Teflon provides a chemically inert system which eliminates any corrosion or leaching of system components which may add unwanted contaminants to the challenge test water. 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.

Test units were installed, conditioned and operated according to the manufacturer's instructions. Pressure gauges and flow meters were installed appropriately to allow documentation of system operation. Spiked challenge water was prepared in 525 gallon lots by adding known volumes of sodium hypochlorite to attain an influent target spike level of 2.0 mg/L FAC. A total of 600 gallons of spiked challenge water was passed through each test unit using an operating cycle of 50 percent on, 50 percent off with a 15 minute cycle during periods of system operation which did not exceed more than 16 hours per day. The initial flow rate from each unit was measured at approximately 0.5 GPM using a constant inlet static pressure of 60 PSIG.

Table 2 provides a summary of the system operation and sampling sequence for the Doulton HIF undercounter drinking water treatment system with Ultracarb. Characteristics of the influent challenge water (control) and combined effluent from the two test units at the start-up of the test and at 100 percent of capacity are presented in Table 3.

Percent of Capacity	Volume Influent Gallons	Sample and Analyze		Comments
		Influent	Effluent	
Initial	10 Unit Volumes	X	X	Start System
10	60	X	X	.
20	120	X	X	.
30	180	X	X	.

40	240	X	X	.
50	300	X	X	.
60	360	X	X	.
70	420	X	X	.
80	480	X	X	.
90	540	X	X	.
100	600	X	X	End Test

Note: Refer to NSF Standard 42, Appendix B, pages B5 and B6 for specific test protocol details.

Table 3		<i>Influent and Effluent Water Characteristics</i>		
Parameter	Influent Control Start-up	Combined Effluent Start-up	Influent Control 100% Capacity	Combined Effluent 100% Capacity
pH	6.3	6.5	6.3	6.2
TDS	230mg/L	285mg/L	265mg/L	273mg/L
Temperature	24C	23C	22C	21C
Turbidity	0.2 NTU	0.2 NTU	0.2 NTU	0.3 NTU

### *Chlorine Reduction Results*

The results of laboratory analysis for the chlorine reduction evaluation are summarized in Tables 4 and 5. The influent data depict the reproducibility of the spiking level and analytical methodology for this analyte. Analyte data points which were below the MDL are labeled with a less than sign "<" and the actual MDL. Effluent chlorine levels less than 0.09 mg/L, were observed in all samples collected from the two identical test units up until the time testing was discontinued at 600 gallons. The percent contaminant reduction was calculated for each of the influent/effluent pairs and is tabulated in Tables 4 and 5. Where effluent chlorine levels were below the MDL, the MDL was used to calculate the reduction percentage. These values are simply given as a greater than sign ">" and the actual calculated percentage.

Table 4		Test Unit 1				
<i>Chlorine Reduction Studies with Ultracarb</i>						
Volume Influent Gallons	Influent Sample Number	Influent Lead Level mg/L	Effluent Sample Number	Effluent Lead Level mg/L	Percent Reduction	Flow Rate (gpm)
Initial	9312046742	1.96	9312046743	<0.01	>99	0.50
60	9312046745	2.24	9312046746	<0.01	>99	0.55
120	9312046748	2.14	9312046749	<0.01	>99	0.57
180	9312046751	1.96	9312046752	<0.01	>99	0.58
240	9312046754	1.97	9312046755	0.08	96	0.55
300	9312046757	1.91	9312046758	0.02	99	0.55

360	9312046760	1.93	9312046761	0.05	97	0.55
420	9312046763	1.93	9312046764	0.01	99	0.56
480	9312046766	1.94	9312046767	0.03	98	0.55
540	9312046769	1.87	9312046770	0.06	97	0.55
600	9312046772	1.87	9312046773	0.03	98	0.55
Table 5			Test Unit 2			
Initial	9312046742	1.96	9312046744	<0.01	>99	0.48
60	9312046745	2.24	9312046747	<0.01	>99	0.40
120	9312046748	2.14	9312046750	0.02	99	0.45
180	9312046751	1.96	9312046753	0.08	96	0.44
240	9312046754	1.97	9312046756	0.04	98	0.45
300	9312046757	1.91	9312046759	0.07	96	0.45
360	9312046760	1.93	9312046762	0.04	98	0.40
420	9312046763	1.93	9312046765	0.03	98	0.50
480	9312046766	1.94	9312046768	0.02	99	0.45
540	9312046769	1.87	9312046771	0.06	97	0.45
600	9312046772	1.87	9312046774	0.06	97	0.40

### Conclusion

The [Doulton HIF undercounter drinking water treatment system](#) containing an [Ultracarb filter cartridge](#) was found to be very effective at removing chlorine from spiked challenge water. Calculated contaminant reduction percentages were greater than 95 percent in both test units evaluated for 600 gallons, which substantially exceeds the current NSF requirement of 75 percent minimum reduction for Class I filters. Based on this set of laboratory results, the Doulton HIF undercounter drinking water treatment system meets the requirements for compliance under NSF Standard Number 42 for taste, odor and chlorine reduction for Class I filters using a capacity rating of 600 gallons.