FINAL REPORT -Spectrum Labs Inc.

DOULTON UNDERCOUNTER DRINKING WATER SYSTEM WITH SINGLE ULTRACARB (CU1200) CERAMIC CANDLE

Lead 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 filration and is available directy 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 lead 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 lead reduction in accordance with test protocol contained in NSF International Standard Number 53, "Drinking Water Treatment Units/Health Effects," Annex B, "Chemical Reduction Performance

Test Methods," Section V, "Method Plumbed In Units Without Reservoir," revised September 1993. Influent challenge waters for the lead reduction evaluation were prepared with an influent target spike level of 0.15 mg/L (150 ppb).

Two separate rests were conducted. one using the high pH and alkalinity challenge water, and one using the low pH and alkalinity challenge water as outlined in NSF Standard Number 53, Annex B under "Metal Reduction Test Waters." Influent and effluent samples were analyzed for lead using EPA Method Number 239.2 which is a graphite furnace atomic absorption spectrophotometry method. The corresponding Method Detection Limit (MDL), EPA Action Level, and Target Spike Level for this analyte is provided in Table 1.

Analytes Selection for Contaminant Reduction Studies

Table 1				
Analyte	EPA Method	Method Detection Limit (mg/L)	EPA Action Level (mg/L)	Target Spike Level (mg/L)
Lead	239.2	0.001	0.015	0.15

Experimental Design

The experimental and mechanical system design for the lead reduction evaluation was based on test protocol contained in NSF Standard Number 53. A mechanical test system plumbed entirely of Teflon was used for this set of experiments. 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. 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. Spiked challenge water was prepared in 525 gallon lots by adding known volumes of lead nitrate to attain an influent target spike level of 0.15 mg/L (150 ppb). Table 2 provides a summary of the system operation and sampling sequence for the Doulton HIF undercounter drinking water treatment system containing an Ultracarb filter cartridge. A total of 720 gallons of spiked challenge water was passed through test units during both the high and low pH and alkalinity lead reduction. An operating cycle of 50 percent on, 50 percent off with a 15 minute cycle was used during periods of system operation which did not exceed more than 16 hours per day. The flow rate from each unit was measured at approximately 0.4 GPM using a constant inlet static pressure of 60 PSIG. Characteristics for the influent challenge water are presented in Table 3. Deionized water was used for the challenge water makeup in order to meet the test water specifications contained in NSF Standard Number 53.

System Operation and Sampling Sequence for the Doulton HIF Undercounter Drinking Water Treatment System with Ultracarb

Table 2		Sample and Analyze		Comments
Percent of Capacity	Volume Influent Gallons	Influent	Effluent	

Initial	10 Unit Volumes	X	X	Start System
25	150	X	X	
50	300	X	X	
75	450	X	X	
100	600	X	X	
120	720	X	X	End Test

Note: Refer to NSF Standard 53, Annex B, pages B3 and B4 for specific test protocol details.

Influent Challenge Water Characteristics

Table 3		
Parameter	Low pH	High pH
Acidity	11mg/L	<10mg/L
Alkalinity	23mg/L	210mg/L
Hardness	11mg/L	120mg/L
pH	6.4	8.3
Polyphosphate	<0.05mg/L	<0.05mg/L
TDS	30mg/L	272mg/L
Temperature	19C	20C
Turbidity	0.2NTU	0.4NTU

Lead Reduction Results

The results of laboratory analysis the lead reduction evaluation are summarized in Tables 4 through 7. The influent data depicts the reproducibility of the spiking level and analytical methodology for this analyte. Effluent lead levels below the NSF Maximum Effluent Concentration of 0.0 15 mg/l were observed in all effluent samples collected from identical test units in both the high and low pH and alkalinity lead reduction evaluations. Calculated contaminant reduction percentages were greater than 95 percent which exceeds the current NSF requirement of 90 percent minimum reduction for lead contained in NSF Standard Number 53. The percent contaminant reduction was calculated for each of the influent/effluent pairs and is tabulated in Tables 4 through 7.

Table 4			Test Unit 1			
Low pH and Alkalinity Lead Reduction Studies						
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	9312045364	0.15	9401001349	0.002	99	0.39
150	9312045591	0.16	9312045592	0.003	98	0.39
300	9312045949	0.16	9312045950	0.004	98	0.40

450	9312046328	0.13	9312046329	0.001	99	0.40
600	9312046443	0.12	9312046444	0.005	96	0.40
720	93120046812	0.14	9312046813	0.002	98	0.44
Table 5			Test Unit 2			
Initial	9312045364	0.15	9401001349	0.005	97	0.35
150	9312045591	0.16	9312045592	0.002	99	0.34
300	9312045949	0.16	9312045950	0.003	98	0.35
450	9312046328	0.13	9312046329	0.001	99	0.34
600	9312046443	0.12	9312046444	0.003	98	0.33
720	9312046812	0.14	9312046813	0.006	96	0.34

Table 6			Test Unit 1			
High pH and Alkalinity Lead Reduction Studies						
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	9312043561	0.16	9312043559	0.002	99	0.50
150	9312044316	0.16	9312044317	0.003	98	0.39
300	9312044642	0.16	9312044643	0.004	98	0.47
450	9312044749	0.16	9312044750	0.005	97	0.47
600	9312044752	0.16	9312044753	0.005	97	0.34
720	9312045367	0.15	9312045368	0.004	97	0.34
Table 7			Test Unit 2			
Initial	9312043561	0.16	9312043560	0.003	98	0.55
150	9312044316	0.16	9312044318	0.004	98	0.53
300	9312044642	0.16	9312044644	0.006	96	0.42
450	9312044749	0.16	9312044751	0.004	98	0.42
600	9312044752	0.16	9312044754	0.005	97	0.38
720	9312045367	0.15	9312045369	0.004	97	0.38

Conclusions

The Doulton HIF undercounter drinking water treatment system containing an Ultracarb filter cartridge was found to be very effective at removing lead from the spiked challenge water. Calculated contaminant reduction percentages were 96 percent or greater in both the high and low pH and alkalinity lead reduction evaluations throughout the entire 720 gallon test. Since the Doulton HIF undercounter drinking water treatment system does not contain a flow monitoring device, this set of laboratory results would establish a capacity rating of 600 gallons for lead reduction claims based on the current requirements for compliance under NSF Standard Number 53 for units tested to 120 percent of capacity.