



# EVALUATION REPORT

5001 East Philadelphia Street  
Ontario, California – USA 91761-2816  
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<http://www.iapmortl.org>

**Report Number:** 2295-21884

**Report Issued:** June 4, 2021

**Project No.:** 35996

**Client:** KD Enterprises  
4348 Waialae Ave 315  
Honolulu, HI 96816

**Source of Samples:** Samples were sent to IAPMO R&T Lab from KD Enterprises and received in good condition on 04/13/2021.

**Location of Testing:** IAPMO R&T Lab, 5001 East Philadelphia Street, Ontario CA 91761

**Dates of Evaluation:** May 14-May 24, 2021

**Product Description:** Water conditioning device model 4" WSPS (HDC)

**Primary Standard:** Custom testing procedure outlined below

**Scope of Evaluation:** The purpose of the testing was to determine what effect the samples described above have on reducing combined chlorine.

**Conclusion:** The pool with the water conditioning device installed had an average of 36% less combined chlorine than the control pool.

**Report Status:** COMPLETE

Reviewed By,

Sal Aridi - Director

*This report replaces report number 2295-21872. It was reissued to correct an editorial in the scope of evaluation on page 1 and to add a reference to NSF 50 listing under Observations on page 2.*

*All testing and sample preparation for this report was performed under the continuous, direct supervision of IAPMO R&T Lab, unless otherwise stated. The statement of compliance is based on the test results compared to the standard specifications without considering measurement uncertainty. The observations, test results and conclusions in this report apply only to the specific samples tested and are not indicative of the quality or performance of similar or identical products. Only the Client shown above is authorized to copy or distribute the report, and then only in its entirety. Any use of the IAPMO R&T Lab name for the sale or advertisement of the tested material, product or service must first be approved in writing by IAPMO R&T Lab.*





**Objective:** to quantify the amount of combined chlorine produced in an HDC treated pool versus a pool that is not HDC treated.

**Setup:** For this test two identical pools pool 1 (with the HDC device installed) had 8155 gallons of water and pool 2 (Control) had 8460 gallons of water were set up side-by-side fitted with the same size cartridge filter (Jacuzzi JCA100 and Hayward CC1000) and ran at the same flow rate of 60 gallons per minute (Figures 1-3) . The plumbing was setup so that there are 2 inlets and 3 returns all on 2-inch pipes (Figure 8). Both pools were maintained at the same parameters PH, alkalinity, hardness, and temperature. The only variable was the amount of chlorine (12.5% Sodium Hypochlorite Figure 4) added to each pool to maintain it at a target of three parts per million free available chlorine (Table 5).

Samples were taken from the return pipe downstream of the HDC device and from the return pipe of the control pool that does not have an HDC device. The samples were analyzed for free (Graph 1) and total chlorine (Graph 2) using HACH DPD pillows, the difference between the two readings is the combined chlorine (Graph 3). Combined chlorine is made of Chloramines, these are undesirable forms of chlorine that result from the combination of chlorine and the contaminants in the pool that are mainly coming from bather load: Urine / sweat / skin / fecal matter etc. In an ideal pool the combined chlorine levels are maintained below 0.5 ppm. In order to simulate some of this bather load a combination of chemicals (Table 1) were added to each pool in equal amounts at the same time (Figure 5). On the days bather load was introduced the amount was equivalent to 100 hours of bathers thrown in a single dose.

Table 1 – Amount of Chemicals in Each Dose of Bather Load

<b>Chemical</b>	<b>Amount</b>
Albumin	9.75 gm
Creatinine	4.25 gm
Ammonium Chloride	10 gm
Urea	30 gm

Table 2 details the events of the test, in preparation for the test, the 2 pools were conditioned by adding equal amounts (2 gallons each) of Instant Balancer muriatic acid.

**Observations:** The combined chlorines for the HDC pool were consistently lower than the control pool especially after adding the chlorine. Figures 6 and 7 show the difference in the dissipation of the bather load observed after several days of running the pools. When the addition of bather stopped the variation between the 2 pools dropped off. The HDC treated pool used 0.3% less chlorine than the control pool.

Note that this device is listed to NSF 50 under report number 2295-20498.





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Table 2 – Data and Chronology of Events

Date	Time	Event	P1-HDC					P2-CNTRL				
			FAC (ppm)	TC (ppm)	COMB (ppm)	ORP	pH	FAC (ppm)	TC (ppm)	COMB (ppm)	ORP	pH
18-May	10:15 AM		2.40	2.74	0.34	640	7.67	2.56	3.14	0.58	639	7.65
	10:55 AM	Added Chlorine to pools										
	1:15 PM		2.58	2.86	0.28	649	7.52	2.60	3.04	0.44	644	7.51
	1:40 PM	Bather load added										
	2:50 PM		1.34	2.20	0.86	626	7.45	1.30	2.90	1.60	625	7.44
	3:25 AM	Added Chlorine to pools										
	4:15 PM		1.54	2.58	1.04	641	7.45	1.96	2.84	0.88	635	7.45
	6:35 PM		1.66	2.86	1.2	674	7.38	1.68	2.94	1.26	681	7.37
	7:00 PM	Added Chlorine to pools										
19-May	8:50 AM		2.10	2.72	0.62	618	7.28	1.68	2.90	1.22	620	7.28
	9:20 AM	Added Chlorine to pools										
	11:25 AM		2.00	3.04	1.04	603	7.54	2.06	2.98	0.92	601	7.55
	12:00 PM	Added Chlorine to pools										
	1:15 PM		2.76	3.08	0.32	607	7.56	1.28	3.16	1.88	600	7.55
	2:45 PM		2.40	2.58	0.18	608	7.52	2.26	2.82	0.56	603	7.51
	3:15 PM	Added Chlorine to pools										
	3:20 PM	Bather load added										
	4:30 PM		1.60	1.84	0.24	615	7.47	1.86	2.16	0.30	598	7.47
	4:50 PM	Added Chlorine to pools										
20-May	8:45 AM		1.98	1.98	0.00			1.54	2.38	0.84		
	9:25 AM		1.86	2.02	0.16			1.62	1.96	0.34		





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	9:45 AM					589	7.35				593	7.55
	9:45 AM	Added Chlorine to pools										
	11:15 AM		1.86	2.44	0.58	589	7.47	2.20	2.68	0.48	589	7.50
	12:00 PM		1.92	2.36	0.44	587	7.55	2.32	2.52	0.20	575	7.54
	12:15 PM	Added Chlorine to pools										
	3:45 PM		1.88	2.26	0.38	583	7.58	1.78	2.44	0.66	593	7.57
	5:00 PM	Added Chlorine to pools										
			FAC	TC	COMB	ORP	pH	FAC	TC	COMB	ORP	pH
	5:30 PM	Bather load added										
21-May	8:15 AM		1.18	1.44	0.26	599	7.34	1.02	1.52	0.5	601	7.33
	8:35 AM	Added Chlorine to pools										
	11:30 AM		1.42	1.94	0.52	607	7.65	1.48	2.10	0.62	600	7.64
	11:50 AM	Added Chlorine to pools										
	3:25 PM		1.91	1.98	0.07	606	7.58	2.02	2.10	0.08	606	7.58
	4:10 PM	Added Chlorine to pools										
	5:20 PM	Bather load added										
22-May	9:00 AM		0.93	1.10	0.17	533	7.61	1.01	1.14	0.13	546	7.68
	9:20 AM		0.91	1.05	0.14			0.91	1.08	0.17		
	9:50 AM	Added Chlorine to pools										
	3:00 PM		1.21	1.33	0.12	587	7.64	1.30	1.41	0.11	586	7.64
	3:30 PM		1.22	1.33	0.11			1.19	1.38	0.19		
	3:40 PM	Added Chlorine to pools										
23-May	10:30 AM		0.95	1.04	0.09	535	7.72	0.98	1.14	0.16	534	7.70





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	11:15 AM	Added Chlorine to pools											
	11:55 AM		1.52	1.63	0.11		7.70	1.51	1.66	0.15			7.72
	12:05 PM	Added Chlorine to pools											
	12:25 PM		1.68	2.10	0.42	576		1.44	2.10	0.66	577		
	1:00 PM		1.80	2.00	0.20	574		1.88	2.28	0.40	570		
24-May	9:25 AM		1.13	1.23	0.10	532	7.70	1.18	1.27	0.09	532	7.69	
	10:07 AM	Added Chlorine to pools											
	10:30 AM		1.50	1.78	0.28			1.46	2.02	0.56			
<i>Combined Chlorine Averages</i>					0.37					0.57			
		<b>Average Reduction in Combined Chlorine</b>						<b>36%</b>					

Table 3 – Operational Parameters

	18-May		19-May		20-May		21-May		22-May		23-May		24-May	
	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2
pH	7.52	7.51	7.54	7.55	7.35	7.55	7.58	7.58	7.61	7.68	7.72	7.70	7.70	7.69
Tot Alkalinity ppm	145	150	146	151	150	NR	145	147	145	155	152	156	151	152
Hardness ppm			188.1	188.1			188.1	171	171	171	188.1	188.1		
ORP	649	644	603	601	589	593	606	606	533	546	535	534	532	532
Flowrate gpm	60	60	60	60	60	60	60	60	60	60	60	60	60	60
TDS ppm	312	316	323	325	336	336	347	346	357	357	364	366	369	374
Turbidity NTU							0.23	0.09					0.22	0.25
Pressure psi	12	11	12	11	12	11	12	11	12	11	12	11	12	11





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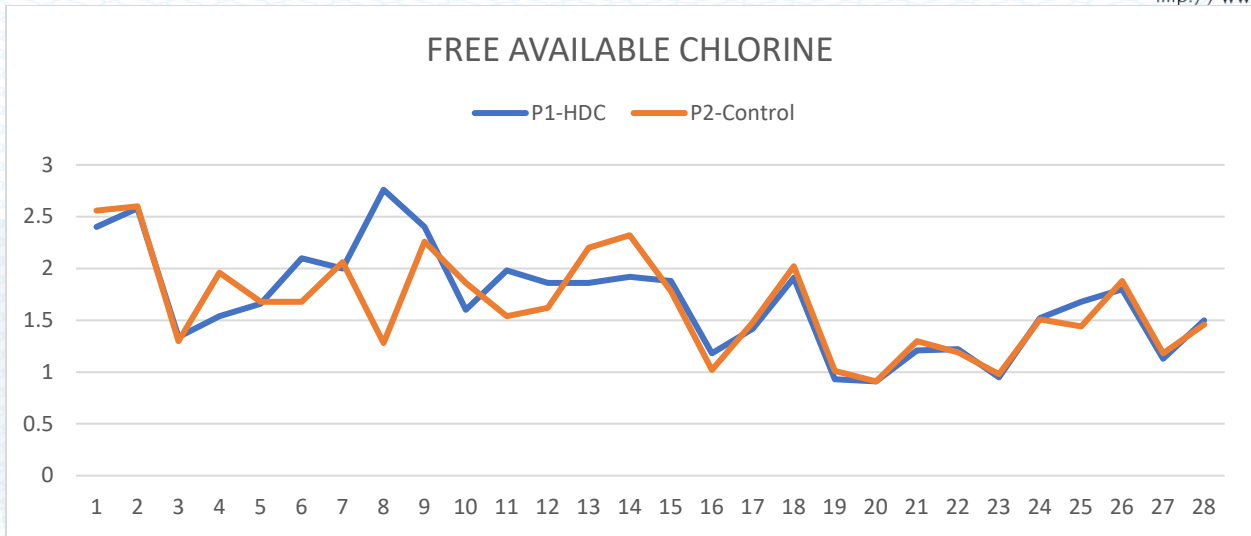
Table 4 – Ambient Data

	18-May		19-May		20-May	21-May		22-May	23-May		24-May
Air Temp °F	78.3	73.8	67.1	84.2	74.2	63	77.8	71.1	80	87.9	93.4
Wet Bulb °F	68.6	63.8	61.5	67.4	63.1	54.7	59.1	56.8	65	66.2	70.2
Relative Humidity %	61.0	57.7	72.9	41.2	53.7	58.4	30.9	39.8	44.0	30.4	30.6

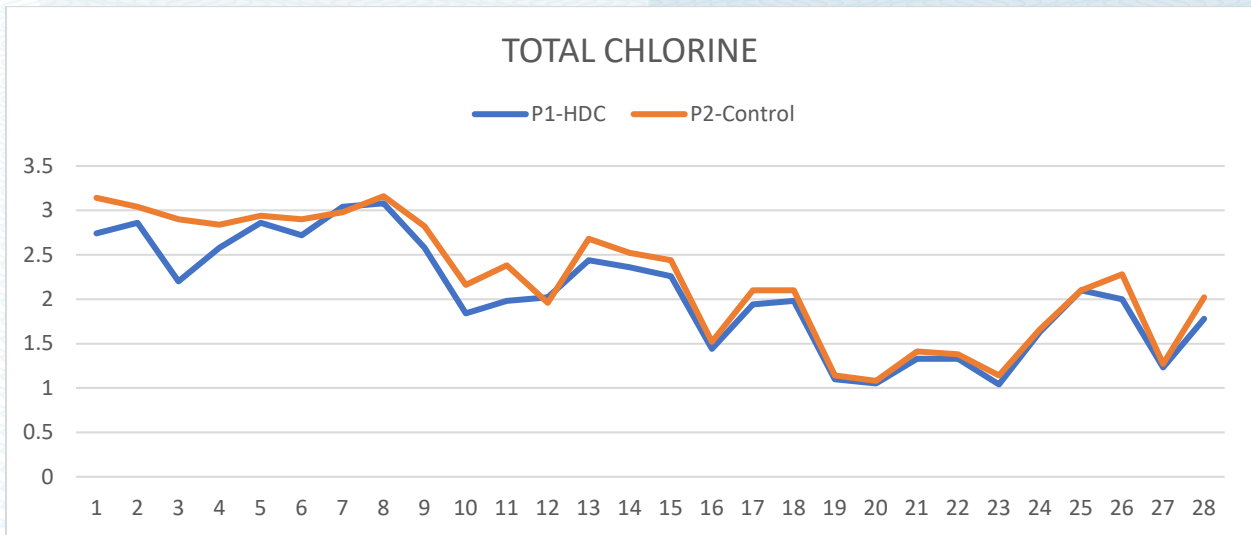
Table 5- Chlorine Consumption Data

	Chorine Consumption				
	Date	Time	P1-HDC	P2-CNTRL	
ml CL Added	18-May	10:55 AM	150	130	
	18-May	3:25 PM	410	420	
	18-May	7:00 PM	330	330	
	19-May	9:20 AM	220	330	
	19-May	12:00 PM	250	230	
	19-May	3:15 PM	150	180	
	19-May	4:50 PM	350	280	
	20-May	9:45 AM	280	340	
	20-May	12:15 PM	270	170	
	20-May	5:00 PM	280	300	
	21-May	8:35 AM	450	490	
	21-May	11:50 AM	390	380	
	21-May	4:10 PM	270	240	
	22-May	9:50 AM	490	490	
	22-May	3:40 PM	300	300	
	23-May	11:15 AM	400	400	
	23-May	12:05 PM	400	400	
	24-May	10:07 AM	400	400	
		Total		5790	5810
	<b>Additional Chlorine added to P2 vs P1</b>				<b>0.3%</b>



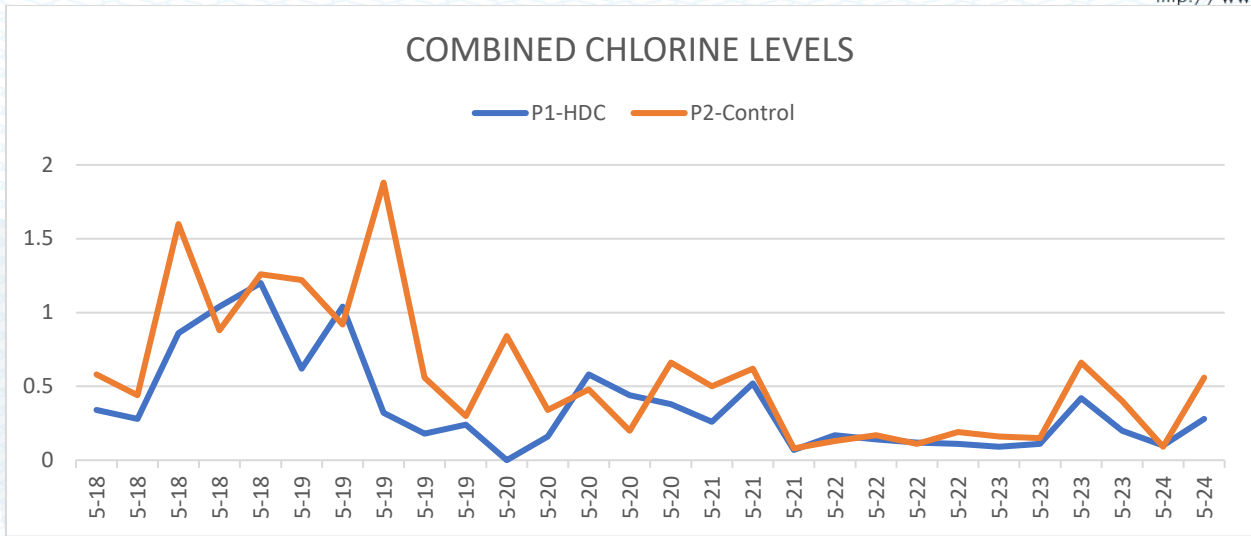


Graph 1- The FAC data taken in Both Pools

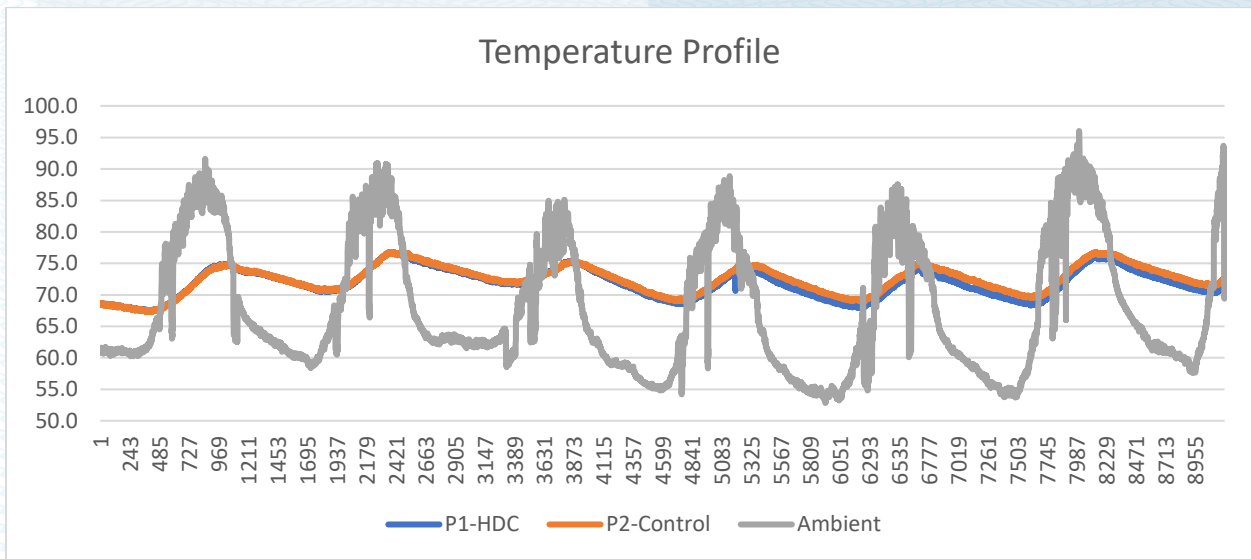


Graph 2- Total Chlorine in Both Pools





Graph 3 – The Combined Chlorine in Both Pools



Graph 4 – the Temperature of the Water in Both Pools and the Ambient Temperature (the dips in the ambient are the wet bulb temperatures for calculating Relative Humidity)





Figure 1 – Two Pools Layout



Figure 2 – Two Pools Layout





Figure 3- Device Under Test



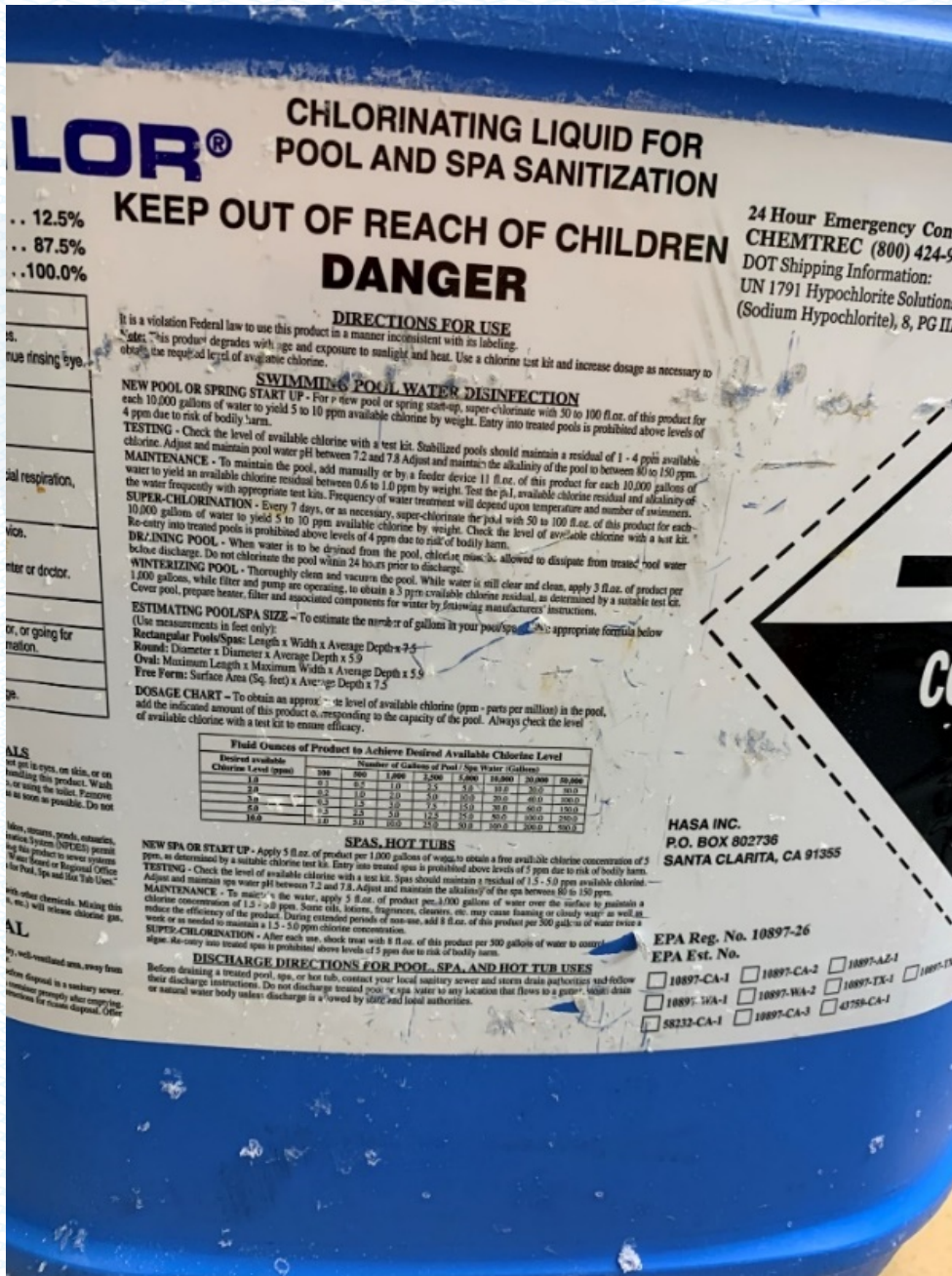


Figure 4 – Chlorine Used



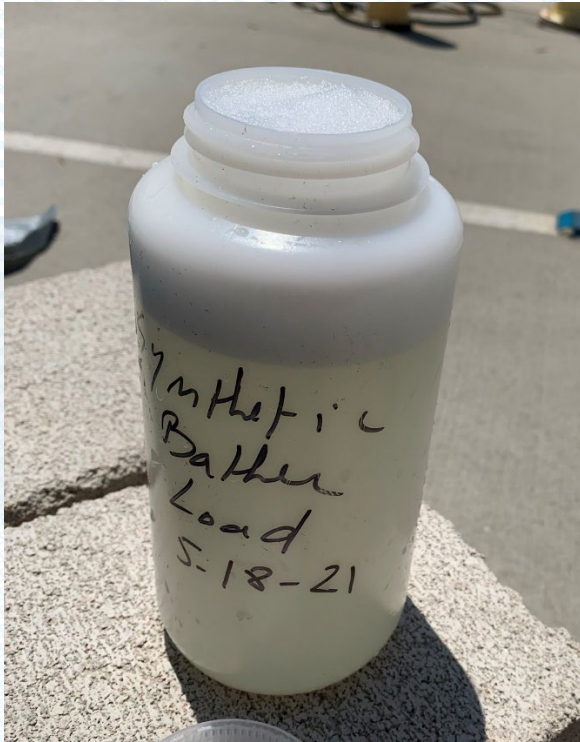


Figure 5 – Bather Load After Mixing With Pool Water



Figure 6- HDC Treated Pool After 1.25 Hours of Introducing the Bather load





Figure 7 – Control Pool After 1.25 hrs of Introducing the Bather Load – Material Still Floating

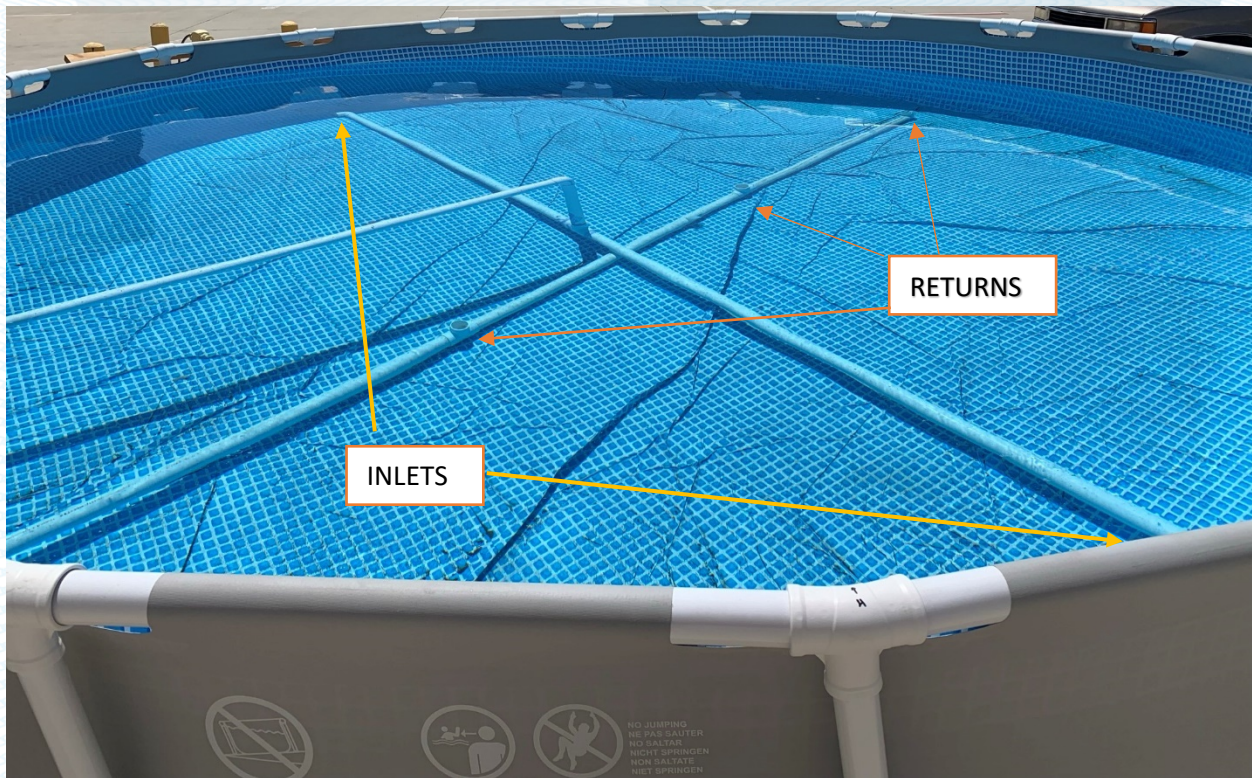


Figure 8- Layout of Inlets and Returns- Same for Both Pools