



# Phenomenal Aire

## *Cold Plasma Generator Technology*

### Case Study: Casino IAQ Improvement

***The American Lung Association states that secondhand smoke is a serious health hazard which causes more than 41,000 deaths per year.*** It can cause, or worsen, a wide range of health effects. Secondhand smoke contains hundreds of chemicals known to be toxic or carcinogenic including those such as: formaldehyde, benzene, vinyl chloride, acetaldehyde, and naphthalene.

Casinos are entertainment venues which still allow patrons to openly smoke while on the premises. The indoor air of a casino can have up to *fifty times (50X)* more cancer causing particles than outside air. For non-smoking patrons, their length of stay limits the duration to which they are exposed to secondhand smoke. However, casino workers are continuously exposed to hazardous levels of toxic secondhand smoke. Through the casino's heating, ventilation and air condition systems (HVAC), the smoke filled air can be distributed throughout the entire building space. This can affect patrons and workers who may or may not be immediately near a smoker. Regardless of exposure time, or proximity, it is a FACT that secondhand smoke poses health risks.

The use of Phenomenal Aire™ Cold Plasma Generator (CPG) technology will help to significantly reduce the distribution of unhealthy air by breaking down many of the chemicals associated with secondhand smoke. Any gaseous chemicals with an ionization potential less than twelve (< 12) are broken down within the plasma field created by Phenomenal Aire™ technology.

In June of 2016, an indoor air test was conducted in a casino located in California. The test was conducted over a two day time period. The intent of the test was to analyze the air quality associated with a specific HVAC system using its existing air filtration technology, and analysis of the same HVAC system incorporating Phenomenal Aire™ CPG technology.

Review and comparison of the attached test data demonstrates that Phenomenal Aire™ CPG technology helped mitigate the presence of smoke and assisted in improving the casino's indoor air quality.



## Successful Test Findings

At the time of testing, the HVAC system’s existing filtration technology demonstrated a successful reduction of particles sized 1 – 10 microns. However, the existing filtration technology was not addressing sub-micron sized particles. Submicron sized particles ranging from the < 1 micron of smoke to that of 0.01 microns of a virus.

Testing on the same HVAC equipment and filtration technology, with the additional use of Phenomenal Aire™, demonstrated successful filtration of submicron sized particles, ranging in size from 0.3 to 0.5 microns.

The introduction of ionization, or charged molecules, results in like particles bonding to other like particles. As particles bond to other particles they become a particle of greater size and mass. The bonding of particles to other particles is referred to as agglomeration. A particle .03 microns in size may increase to .05 microns. A particle .05 microns may increase in size to 1 micron, etc. As the particulates increase in size the effectiveness of the air filtration technology also increases. Which, accounts for the results demonstrated in the casino HVAC filtration technology.

At the time of testing, physical limitations of the indoor air monitoring technology did not allow for the measurement of particles as small as 0.01 microns. However, while the meter technology was limited to measurements greater than 0.01 microns, the physical principals of particle agglomeration are not limited to the initial size of a particle. Therefore, it can be assumed that particles with initial measurements, as small as .01 microns, also grew in size and ultimately became subject to capture and reduction over time.

Outside Air							Inside Casino Air						
Date Time	0.3µm df	0.5µm df	1.0µm df	2.5µm df	5.0µm df	10.0µm df	Date Time	0.3µm df	0.5µm df	1.0µm df	2.5µm df	5.0µm df	10.0µm df
21-Jun-16 12:43:58 PM	130472	26423	10100	2563	122	39	21-Jun-2016 10:22:30 AM	131475	6714	308	34	5	13
21-Jun-16 12:51:01 PM	132418	25878	9758	2415	86	25	21-Jun-2016 10:28:33 AM	136967	7515	487	116	17	13
21-Jun-16 12:58:04 PM	132866	25393	9351	2324	77	25	21-Jun-2016 10:34:36 AM	143499	7608	381	56	6	4
21-Jun-16 01:05:07 PM	139290	24257	8659	2221	80	33	21-Jun-2016 10:40:39 AM	147318	8027	596	138	25	11
21-Jun-16 01:12:10 PM	158733	24523	9220	2469	113	62	21-Jun-2016 10:46:42 AM	145201	7687	430	89	7	8
21-Jun-16 01:19:13 PM	165712	24096	8410	2026	64	27	21-Jun-2016 10:52:45 AM	140985	7584	413	61	4	3
21-Jun-16 01:26:16 PM	170357	23607	8317	1923	50	10	21-Jun-2016 10:58:48 AM	138194	7500	341	46	2	1
21-Jun-16 01:33:19 PM	170848	24938	9029	2429	90	44	21-Jun-2016 11:04:51 AM	134376	7195	355	34	2	0
21-Jun-16 01:40:22 PM	171296	25163	9473	2641	125	41	21-Jun-2016 11:10:54 AM	135172	7146	316	33	5	0
Average	152444	24964	9146	2335	90	34	21-Jun-2016 11:16:57 AM	137291	7159	316	19	0	0
							Average	139048	7414	394	63	7	5
22-Jun-16 09:42:55 AM	131527	20033	7662	1814	99	44	Phenomenal Aire OFF						
22-Jun-16 09:49:58 AM	135240	19756	7228	1716	117	35	22-Jun-16 11:07:57 AM	322095	12501	352	34	1	1
22-Jun-16 09:57:01 AM	135845	19661	6664	1770	112	39	22-Jun-16 11:15:00 AM	333041	13289	389	36	4	3
22-Jun-16 10:04:04 AM	132653	20463	7017	1711	103	50	22-Jun-16 11:22:03 AM	371986	14936	375	62	11	4
22-Jun-16 10:11:07 AM	131375	19981	6674	1822	117	45	22-Jun-16 11:29:06 AM	380638	15166	473	115	24	72
22-Jun-16 10:18:10 AM	131822	20022	6778	1791	113	45	22-Jun-16 11:36:09 AM	382663	14672	406	56	4	6
22-Jun-16 10:25:13 AM	133852	20541	6695	1837	136	50	22-Jun-16 11:43:12 AM	381757	14591	437	46	4	11
22-Jun-16 10:32:16 AM	131531	19784	6523	1744	100	61	22-Jun-16 11:50:15 AM	367470	13905	432	57	5	5
22-Jun-16 10:39:19 AM	128838	19423	6353	1641	101	40	22-Jun-16 11:57:18 AM	347221	12857	496	102	22	19
Average	132520	19963	6844	1761	111	45	22-Jun-16 12:04:21 PM	349523	12645	494	33	6	1
							22-Jun-16 12:11:24 PM	362690	13569	447	46	8	10
							Average	359908	13813	430	59	9	13

