



## **Evaluation of Air Quality and Effects of a ID-500 Ionisation Units (Airganix) Installed in Air Conditioning at West Pennant Hills Sports Club, Games Room**

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### **Summary**

The ionisation of the air by the ionisation units (Airganix) units in the Games Room resulted in:

- i. a reduction of bacteria levels in the air by 49%
- ii. a reduction of mould levels in the air by 23%
- iii. air borne particles were reduced by 49%
- iv. odours in the air due to smoke and other smells were reduced by 59%
- v. ozone levels due to the ionisation units were below detection limits of 0.003 ppm which is less than 1/30<sup>th</sup> of the maximum allowable ozone levels of 0.1ppm

### **Background**

The effect of ionisation on air quality by an ID-500 ionisation unit (Airganix) installed in the air conditioning ducting was examined in the Games Room at West Pennant Hills Sports Club. There had been problems with odours and air-borne particulates (*eg.* cigarette smoke) in this room and the ionisation technology was installed to attempt to cleanse the air.

A variety of tests were performed to determine the air quality in the room by sampling from various locations throughout the room. Tests were done with the ionisation machine turned off and then with the ionisation turned on. These tests included:

- Air-borne microorganisms, both moulds and bacteria
- Air particles (dust, fibres, smoke particulates etc) >0.1 µm in size
- Odours – the sampling and analysis methods used (gas chromatography and SPME sampling) can monitor a range of human, food and smoke odours in the air.
- Ozone production using Draeger gas sampling and analysis technology.

The tests were performed in the Games Room between 6:00 pm and 8:30 pm on Friday 21<sup>st</sup> July and Saturday 22<sup>nd</sup> July, time periods when the number of patrons in the room was very high and activity was busy. The ionisation units were turned off 20 hours prior to the no ionisation tests (to ensure no carryover from potential ionisation effects), while for the ionisation tests the units had been running for over 20 hours.

## Results

### 1. Air-borne microorganisms

Petri dishes containing Nutrient Agar medium to promote microbial growth were exposed to the air for various times with and without ionisation in the Games Room, West Pennant Hills Sports Club.

When all times were averaged, the bacterial levels in the air were reduced on average by more than 49% when the ionisation unit was running (Table 1), while the reduction in mould levels was lower at only 23% on average. Total reduction of air-borne microorganisms while the ionisation unit was operating was 45%.

Table 1. Reduction in mould and bacteria in the air in the Games Room, West Pennant Hills Sports Club

Time the test plate was exposed (minutes)	No ionisation (per plate)	With ionisation (per plate)	% reduction due to ionisation
<b>Mould</b>			
30 min	1.9	1.6	<b>16%</b>
60 min	3.7	2.6	<b>30%</b>
<b>Average effect on mould</b>			<b>23% reduction</b>
<b>Bacteria</b>			
30 min	9.4	4.3	<b>54%</b>
60 min	18.0	10.1	<b>44%</b>
<b>Average effect on bacteria</b>			<b>49% reduction</b>
<b>All microorganisms</b>			
30 min	11.3	5.9	<b>48%</b>
60 min	21.7	12.7	<b>42%</b>
<b>Average effect on microorganisms</b>			<b>45% reduction</b>

### 2. Air particles

Two types of air monitoring equipment were used to test for the level of air-borne particles:

- TSI 8520 DustTrak Monitor - used to sample air-borne particles from size range 0.1 to 10  $\mu\text{m}$  with resolution of 1% of reading or 0.001  $\text{mg}/\text{m}^3$ , in various areas of the Games Room
- Millipore 37mm Aerosol Analysis Monitor - air was passed through the monitor with 0.8  $\mu\text{m}$  filter (MAWP037A0) at 4.5 L/min for 30 minutes using a vacuum pump in order to capture particles in the air. The aerosol monitor was positioned near the Bar/Lucky Wheel stand (sampling area B; see Appendix 1). Particles embedded on the filters greater than *ca.* 10 $\mu\text{m}$  were counted using a binocular microscope.

### ***TSI 8520 DustTrak Monitor***

Overall, there was a reduction in air-borne particles (0.1 to 10 µm in size) by about a half (49%) of the previous levels due to ionisation (Table 2). Sampling area A, which was situated in the top end of the games room (see Appendix 1) and considered by management as a problem zone for odours and stale air, showed the highest particle load (0.837 mg/m<sup>3</sup>) when the ionisation unit was not operating. In deed in this problem area particular matter levels were more than double average level of the other four sampling location. When the ionisation unit was turned on particle levels in this problem area were reduced by 69%. This observation reinforces that made elsewhere, that the biggest effect of ionization technology is observed when air quality is a problem.

Table 2. Reduction in particulate levels in the air in various areas of the Games Room, West Pennant Hills Sports Club

<b>Sampling areas</b>	<b>No ionisation (mg/m<sup>3</sup>)</b>	<b>With ionisation (mg/m<sup>3</sup>)</b>	<b>% reduction due to ionisation</b>
A	0.837	0.256	<b>69%</b>
B	0.372	0.140	<b>62%</b>
C	0.627	0.418	<b>33%</b>
D	0.382	0.170	<b>56%</b>
E	0.242	0.186	<b>23%</b>
<b><i>Average effect on particles</i></b>			<b>49%</b>

### ***Millipore Aerosol Analysis Monitor***

Average particle counts near the Lucky Wheel (sampling point B, see Appendix 1) for:

- No ionisation present was 274 / m<sup>3</sup>,
- Ionisation units turned on was 293 /m<sup>3</sup>.

There appears to be no reduction in particles with size >10µm due to ionisation of the air, possibly because the conventional filters used in the air-conditioning system were able to remove larger particles (>10µm) from Games Room. However, conventional filters might not have ability to extract smaller air particles (<10µm), which were detected using the TSI 8520 DustTrak Monitor. The location of this type of air sampling testing which needed a powerful pump and air sampling on a stand was limited to one location in the room near the Lucky Wheel. Unfortunately, the air in this location was not always representative of the typical room air, as it was very close to an external door that was frequently opened for periods of time. Therefore, the lack of significant differences from these tests would be readily explained by the sampling location.

### 3. *Smoke and Odours*

Air at the casino was sampled in 45ml vials, which were exposed to the air for 60 minutes before being sealed. Prior to analysis for odours, the vials were heated to 50°C for 15 minutes to ensure that no odours were attached to the sides of the vials. Odours were then concentrated by being absorbed for 30 minutes onto SPME fibres. Samples were then analysed by gas chromatography using a temperature gradient from 40 to 220°C and a FID detector.

The average total peak area counts of odours in the air for five samples:

- |     |   |       |
|-----|---|-------|
| i.  | Without ionisation aroma total peak areas = | 5,717 |
| ii. | With ionisation aroma total peak areas =    | 2,331 |

The reduction in odour levels in the Games Room due to smoke and other human and food odours due to ionisation was 59%. The major peaks found in these samples and which were reduced by ionization were typically from cigarette smoke.

### 4. *Ozone*

Ozone in the Games Lounge which had a CX-600 ionisation unit in the airconditioning was sampled using a Draeger Multi Gas Detector. Draeger ozone gas tubes (Part No. 6733181) based on sampling a precise volume of air and a specific reaction with chemical agents. For low to very low ozone levels of  $\leq 0.05$  ppm and especially for ozone free air Draeger gas tubes are very accurate, and considerably more accurate than commonly used electronic meters.

Results showed that ozone in the Games Lounge was below measurable levels of 0.003 ppm during the sampling periods, including Saturday evening when the ionisation unit was turned on. Ozone levels in the room are therefore well below the maximum eight hour limit of 0.1 ppm ozone, as they are below the most accurate limit of detection, which is less than 3% of the current Australian standard limit for ozone, or less than 1/30<sup>th</sup> of maximum safe levels.

Additionally ozone sampling was carried out in the Lounge room adjacent to the Games room. The air was purified in this room with an EULOQUEST Eagle 500 ionisation unit. Ozone levels were 0.008 ppm ozone immediately in front of the unit and <0.003 ppm in the centre of the room, giving an average of about 0.005 ppm ozone in the Lounge area. This is 5% of the current Australian standard limit for ozone, or 1/20<sup>th</sup> of maximum safe levels.

Signed



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Managing Director

## Appendix. 1

General schematic of the Games Room, West Pennant Hills Sports Club, and sampling sites for odours (1,2,3,4,5,6), microorganisms (i, ii, iii, iv, v, vi, vii), and air-borne particulates of 0.1-10 $\mu$ m in size (A, B, C, D, E) and >10 $\mu$ m in size ( $\Delta$ ). Poker machines areas are designated as 

