

# Improved Indoor Air Quality And ROI In Contact Centers

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**Summary:** *Contact centers are among the most controlled and most measured office environments. It is surprising to see how relatively little attention is given in these offices to indoor air quality and its impact on the well-being and performance of the employees. Living plants are said to improve IAQ but exact measurements are seldom made. We want to demonstrate living plants' impact on relative humidity, on the presence of VOCs and their economical ROI in the live environment of a Belgian contact center.*

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## 1 Introduction

The first requirement for a healthy company is a healthy human climate: managers who respect employees and their work are 10 times more effective for a healthy environment than any physical change can accomplish.

But once the human dynamics work well and once efficient work processes are in place, what else can you do as a manager to create a stimulating and healthier work environment? Then improvements of the physical environment can help.

## 2 Healthy Air in Contact Centers

Healthier indoor air is just one small factor that can contribute to a more stimulating environment. But in times when 0.01% differences are critical, it is worthwhile to investigate how indoor air quality improvements can give companies a competitive edge.

One way of improving indoor air quality is by introducing green plants.

Lots of literature is published on their beneficial effects; green plants are said to be able to:

- clean the air from toxic VOCs
- increase the relative humidity of the air
- reduce sickness absence
- reduce stress

## 3 Contact center case

In 2000, Sutter Verlag in Essen, Germany, managed to reduce sickness leave and staff turnover substantially, by turning their contact center into a green, living plants landscape.

Contact centers will overstaff to meet contractually agreed upon service levels. Depending on center size, a 10% decrease in sickness leave can thus lead to a return of 1,000s or 10,000s € in net savings.

The Sutter case is 5 years old and no hard data were collected at that time, neither on IAQ nor on the financial return on investment.

We therefore started with a research project in a Belgian contact center, aiming to provide these hard data.

The chosen contact center is run by Proximus, Belgium's leading mobile operator and is located in the centre of Antwerp, Belgium's second largest city.



Fig. 1. Belgacom building with Proximus offices on 1<sup>st</sup> and 2<sup>nd</sup> floor

With this project, we want to answer 3 questions:

1. To what extent can living plants increase the relative humidity in a staff intensive office.
2. To what extent can living plants clean the air from prevalent VOCs.
3. Does an investment in living plants provide a net return, i.e. through reduced staff related costs (lower sickness related absenteeism, lower turnover) and/or through productivity increases.

To be meaningful, the project will run throughout 2006. The results presented in June at the Lisbon conference will be those obtained up to that stage.

The return on investment question can first be answered after the test period, early 2007, comparing the plants investment with possible savings through lower sickness leave and/or higher productivity in the period March through December 2006 versus the same period in 2005.

On purpose, a center has been chosen with no particular problems. This is a normal office, like so many others. We want to investigate whether the introduction of green plants can further improve an already relatively healthy climate. in a normal, staff intensive office.

Most of the projects run in the past by Australian [1] and German [2] companies investigated the humidifying and cleaning effects of plants in a problematic environment, with a high sickness rate and /or a high concentration of VOCs.

#### 4 Site data

Proximus runs its call centres in various locations across Belgium. We chose their Antwerp office because the airflow (ventilation and airconditioning) in this four floors building is separately controlled per floor. The building is located along Lange Nieuwstraat 106.

IAQ has been measured in the situation as it is, in two open plan offices, T and P. Afterwards, plants were placed in office P, nothing was changed in office T.

The two chosen offices are located on the first (office T) and second floor (office P) of the building, right on top of each other and facing the same Jezusstraat. They have a similar shape and the same windows but the volume of P is 23% larger than T.



Fig. 2. View of office P on 2<sup>nd</sup> floor

In both offices the air is refreshed at a rate of 6000 m<sup>3</sup> per hour. Office T has a total open space surface of 441,51m<sup>2</sup> and a height of 370 cm, which gives it a total volume of 1644,69 m<sup>3</sup> There are 79 air changes per 24 hours, or 3,3 air changes per hour.

Office P has a total open space surface of 593,16 m<sup>2</sup> and a height of 340 cm, which gives it a total volume of 2016,74 m<sup>3</sup>. There are 58 air changes per 24 hours, or 2,4 changes per hour.

Office T is manned by an engineering network service team of 20 people, office P is manned by 70 persons of the general customer service team. This staffing is stable during regular office hours from 8.00 to 17.00 hours.

Both offices are manned 24 hours with a limited staffing of 2 and 5 persons respectively, during evening and night shifts.

The windows are never opened. They have been locked a number of years ago to prevent interference with the airco system.

For a number of years, five standing pot plants have been present in office P, seven in office T, for decorative purposes. They will remain there during the test period.

We are aware of the fact that this is not a laboratory environment with scientifically controlled air flows. The objective of this project is to find out the measurable impact of adding green plants in a normal, “live” open space working environment, where nothing is changed except for the adding of the plants.

With normal, we mean that people walk in and out via the 2 office access doors and they circulate inside the open space. Because of the nature of their work, more than 90% of their time is spent at their desk, throughout the day and throughout the year.

Given those real life circumstances, care has been taken to make the measurements as scientifically valid and relevant as possible. Identical equipment is used for each measurement and the temperature/relative humidity meters and VOC pumps are placed on the same locations in both offices, for all tests.

#### 5 Test descriptions

Three types of measurements are made :

- temperature and relative humidity
- residual CO<sub>2</sub>
- VOC concentration

Temperature and relative humidity are measured each 10 seconds between 09:00 and 17:00 hours with Hobo U12 data logger equipment from Onset Computer Corporation.

CO<sub>2</sub> measurements are made between 11:00 en 12:00 hours with Testo 400 equipment (Hotek Technologies) by external health and prevention service Arista, licensed and approved by Belgian social security.

The VOC routine-analysis is made with air pumps, rented from and calibrated by the Laboratory of Occupational Hygiene and Toxicology of KUL, Leuven University, located Kapucijnenvoer 35 in 3000 Leuven. The analyses are made by staff under the supervision of professor H. Veulemans.

The test comprises the identification and quantification of 170 different volatile organic compounds in air samples, taken on an active charcoal tube., during an exposure of 8 hours with an extraction of 1 liter of air per minute.

Each sample is systematically checked for the presence of the 170 different components. Analysis is performed by gas chromatography (GC) with Flame Ionisation Detection (FID).

## 6 Initial test results

Measurements were made of the actual situation in both offices on 22 February 2006, from 9:00 to 17:00 hours. This was a dry sunny winter day. The outside temperature averaged 3 °C and the relative humidity of the outside air was on average 68%.

The indoor office results showed:

### Office P

- Average relative humidity: 43.4%
- Average temperature: 20.7 °C
- Overall VOC concentration 45 µg /m<sup>3</sup>

In a VOC sample volume of 488.6 litres, collected during 480 minutes, concentrations detected in µg/m<sup>3</sup>, as per KUL laboratory results, were:

VOC	Concentration µg /m <sup>3</sup>
Ethanol	7.6
Aceton	7.5
Iso- Propanol	6.7
Benzene	1.4
Toluene	4.2
Ethylbenzene	1.2
Limonene	6.8
m-Xylene	1.7

### Office T

- Average relative humidity: 47.6%
- Average temperature: 21.8 °C
- Overall VOC concentration 40 µg/m<sup>3</sup>

In a VOC sample volume of 479.3 litres, collected during 481 minutes, concentrations detected in µg/m<sup>3</sup>, as per KUL laboratory results, were:

VOC	Concentration µg /m <sup>3</sup>
Ethanol	4.0
Aceton	8.3
Methylacetate	1.8
Benzene	1.3
Toluene	2.9
1-Butanol	2.3
Limonene	6.0
n-Dodecane	1.1
m-Xylene	1.4

Arista measurements made on 13 March 2006, showed a CO<sub>2</sub> concentration of 555 ppm for office P and a concentration of 513 ppm for office T.

Both these figures are well below the 800 ppm treshold, the Belgian norm for sufficient air refreshment.

In summary, all these figures – relative humidity, temperature, VOC and CO<sub>2</sub> concentration - show an overall healthy environment. None of the concentrations exceed the treshold values set by Belgian government and the international norms from WHO.

To further increase the relative humidity and to combat the highest concentrations of VOCs detected, plants selected were:

- dracaena deremensis (Janet Craig)
- dracaena Warneckii
- spatiphyllum sp. ( peace lily)
- chrysalidocarpus lutescens (areca palm)



Fig. 3. Areca palm

These species were selected in particular, following the recommendations from Dr. B.C Wolverton[3], who combined the results of NASA research in 1980 with his own research performed in 1990 by Wolverton Environmental Services,Inc.

It will be interesting to see whether even such small concentrations of VOCs can be further reduced by the plants.

Specifically, the following 90 plants were placed:

- 6x Areca 120cm
- 18x Areca 100cm
- 5x Dracaena Janet Graig 80cm
- 10x Dracaena Janet Graig 40cm
- 5x Dracaena Warneckii 80cm
- 10x Dracaena Warneckii 40cm
- 36x Spathiphyllum 40cm

The 24 Areca palms were placed per 3 in 8 pots on the ground, the other 66 plants came per 3 in 22 pots on top of filing cabinets which stand between desks, distributed across the open space.

Plants were placed on 15 March and will be maintained, once monthly, during the test period from 15 March till 31 December 2006, by professional plants supplier Aquarella.

To avoid soil acid and parasites, the hydroponics method is used instead of regular soil.

The hydroponics method is nothing else than an imitation of a natural process, where the root system of the plant survives on a diluted compound of water, oxygen and nutrients. The hydro granules used are made of baked clay. They are pure, odorless and decomposable.

A water metre regulates the water supply. For this specific test, plants will be maintained exactly in the same way as what Aquarella would do for their normal plant maintenance contracts. Their staff will pass the first week of each month to fill all pots with sufficient fresh water supply.

All plants were placed in office P on 15 March and air quality measurements of relative humidity, temperature and VOC concentration in both offices are planned to take place 19 April, 18 May, 13 September and 13 December 2006.

Together with the initial measurement of 22 February, this leads to 5 measurements, giving us a fair picture of the impact of the plants during the different seasons and different outside air conditions.

## 7 Return on investment

As indicated in section 3 above, the return on the plants investment in productivity gains and possibly lower absenteeism and staff turnover can first be made in the beginning of 2007, once the March to December test period is over. This period can then be compared with 2005 data for the same population.

The chosen 90 plants with their 30 pots are serviced by Aquarella at an all-in rental contract costing less than 3,000€ on a yearly basis.

By comparison, the average wages and benefits cost per employee, including social security, is around 32,000€ per year or 2,666€ per month

## 8 Preliminary results

The VOC analyses made on 18 May, compared to the 22 February measurements, **show a 44% decrease in total VOC concentration**, from 45 to 25  $\mu\text{g}/\text{m}^3$ , in planted room P versus a 25% increase, from 40 to 50  $\mu\text{g}/\text{m}^3$  in room T.

Specific VOCs, such as limonene and iso-propanol decrease dramatically, others such as acetone show an increase.

In May, Room P shows 15% higher temperature than room T. Relative humidity remains higher in room T throughout, but the humidity difference decreases from 4.3 actual percentage points in February (47.6 vs 43.3), before planting, to 1.8% in May. (46.1 vs 44.3)

Full results, including ROI figures, will be published in January 2007 when the project will be completed.

## References

- [1] Michael Mohrlang *Projekt Das Grüne Büro*. (2003) BMW internal study, published as white paper on [www.healthygrowth.org](http://www.healthygrowth.org)
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- [3] Dr. B.C. Wolverton *How to grow fresh air*. (2004) pp. 23-26, Penguin Books, 1997.