SGS Tecnos, S.A.

Prevention and Environment Division

ECOQUEST

Equipment Test ECO QUEST FRESH AIR to measure chemical pollutants



WORK #: 138689

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Performed by:

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1. INTRODUCTION

1.1 Purpose

The purpose of the study is to present the data from the environmental analysis conducted in an unoccupied and closed laboratory room to assess concentrations of ozone and hydrogen peroxide reached with the air handling equipment ECO QUEST FRESH AIR running.

1.2 Scope

The study was performed during the month of November 2009 in SGS TECNOS laboratories located in C/ Trespaderne, 29 (Madrid)

The study was conducted in:

- A laboratory room (approximately 42 m 3) without special conditions of temperature and humidity control in order to simulate the actual and usual operation of this equipment.

Picture of the equipment under study

1.3 Development

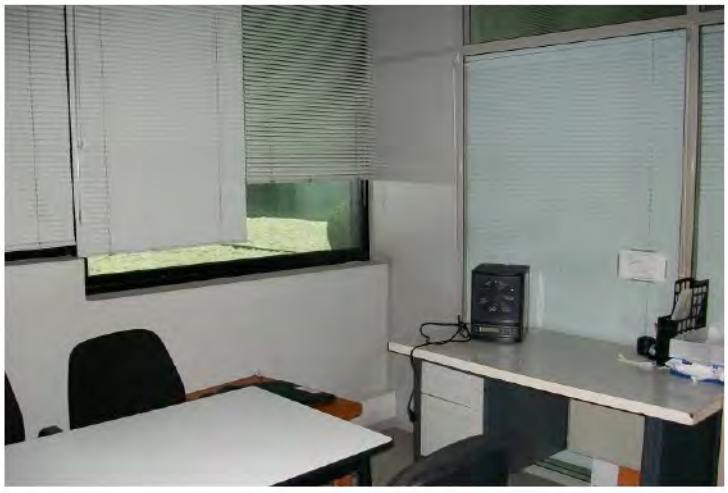
The testing process includes the following actions:

Within the SGS Laboratory, six (6) samples in total will be taken as follow:

- Phase I: Room without conditioning.
    - Three samples of ozone and hydrogen peroxide will be taken: 1/2 hour after an estimated hour (9:00 A.M.), 4 hours after; and 8 hours after.

- Phase II: Room conditioned with purification system (the same previous stages are repeated):
    - Three samples of ozone and peroxide will be taken in different times: 1/2 hour after starting the equipment; 4 hours later and 8 hours later.

The equipment start-up has been performed with the *POWER button in RCI mode and without using the Ozone function*. The fan speed was in level 5 (highest)

	Picture of the room with the equipment located in the room

1.3.1 Ozone

Ozone is a chemical compound consisting of three oxygen atoms.

In nature, it is mainly generated by the solar radiation effect on atmospheric oxygen. It is also generated, in small quantities, when there are lightning storms. This phenomenon is used for the artificial generation of ozone by electric shock.

In urban environments, organic compounds emitted by automobile exhaust react by photo-oxidation, producing ozone as a byproduct. Therefore, the levels depend on traffic and weather conditions.

Inside, various equipment such as printers, photocopiers, etc. generate ozone.

Assessment criteria

R. D. 1494/1995, dated September 8th, on ozone air pollution (BOE # 230, 26-09-1995) sets a maximum allowed limit of 110 µg/m3 (55 ppb).

The INSHT sets a ceiling value for occupational exposure, i.e. which cannot be exceeded at any time, equal to 0.1 ppm (200 µg/m3). Indoors, the SGS takes as reference value one tenth of the VLA value, this being 0.01 ppm.

Performing the evaluation

To determine the ozone concentration in air in suspected areas a known volume of air is circulated through a filter impregnated and preweighed. Method OSHA ID- 214.

Evaluation criteria

The evaluation was performed considering the values set in the relevant standard distinguishing between a recommended minimum and maximum value.

The following table shows the acceptable limit values.

Maximum environmental limit value (ELV)	0.10	ppm
Minimum environmental limit value	0.01	ppm

1.3.2 Hydrogen peroxide

Hydrogen peroxide (H_2O_2), also known as peroxide, is a chemical compound with characteristics of a highly polar liquid, strongly bound to hydrogen such as water, which usually appears as a liquid slightly more viscous than the latter. It is known to be a powerful oxidant.

At room temperature, it is a colorless liquid with a bitter taste. Small amounts of gaseous hydrogen peroxide occur naturally in the air. Hydrogen peroxide is unstable and quickly decomposes to oxygen and water with heat release. Although it is not flammable, it is a powerful oxidizing agent which can cause spontaneous combustion when in contact with organic matter or some metals such as copper, silver or bronze.

Hydrogen peroxide is found at low concentrations (3 to 9%) in many household products for medicinal purposes and as a bleaching agent for clothing and hair. In industry, hydrogen peroxide is used in higher concentrations to bleach fabrics and paper pulp, and at 90% as a component of rocket fuel and for making foam rubber and organic chemicals. In other areas, such as research, it is used to measure the activity of some enzymes such as catalase.

Hydrogen peroxide is a general antiseptic. Its mechanism of action is due to its oxidizing effects: it produces OH and free radicals which attack a wide variety of organic compounds (including lipids and proteins making up cell membranes of microorganisms). The enzyme catalase present in tissues rapidly degrades hydrogen peroxide, producing oxygen, which makes anaerobic spore germination difficult.

Assessment criteria

The exposure lim3it to hydrogen peroxide in the long term (TWA eight hours) is 1.4 mg/m as outlined in the Environmental Limit Values for 2009 published by the Institute of Occupational Safety and Health at Work.

The INSHT specifically suggests reducing to one tenth of the value of the ELV, which in this case would be to 0.14 mg/m3. This standard has been adopted by SGS for indoor environments.

Performing the evaluation

To determine the hydrogen peroxide concentration in air in suspected areas a known volume of air is circulated through a $TiOSO_4$ absorbing solution. Method OSHA ID 126SG.

Evaluation criteria

The evaluation was performed considering the values set in the relevant standard distinguishing between a recommended minimum and maximum value.

The following table shows the acceptable limit values.

Maximum environmental limit value (ELV)	1	ppm
Minimum environmental limit value	0.1	ppm

2. RESULTS

There is a table with the results obtained during the course of sampling below:

Location: Laboratory Room

2.1 Hydrogen peroxide

The following table provides the relationship of data obtained from the room without conditioning, i.e. without the equipment running.

Sample Start Time	Concentration (ppm)	Limit value considered (ppm)	Conforming
9:30. 30 minutes	<0.01	0.1	**YES**
13:00. 4 hours	<0.01	0.1	**YES**
17:00. 8 hours	<0.01	0.1	**YES**

The following table provides the relationship of data obtained from the equipment ECO QUEST FRESH AIR running:

Sample Start Time	Concentration (ppm)	Limit value considered (ppm)	Conforming
9:30. 30 minutes	<0.01	0.1	**YES**
13:00. 4 hours	<0.01	0.1	**YES**
17:00. 8 hours	<0.01	0.1	**YES**

To verify and validate the analytical results 2 blanks have been performed for each measurement day. In both cases, the determinations were found to be below the detection limits of the analytical method. Therefore, no prior pollution was detected in the analyzed samples.

2.1 Ozone

The following table provides the relationship of data obtained with the room without conditioning, i.e. without the equipment running.

Sample Start Time	Concentration (ppm)	Limit value considered (ppm)	Conforming
9:30. 30 minutes	<0.007	0.01	**YES**
13:00. 4 hours	<0.007	0.01	**YES**
17:00. 8 hours	<0.007	0.01	**YES**

The following table provides the relationship of data obtained from the equipment ECO QUEST FRESH AIR running:

Sample Start Time	Concentration (ppm)	Limit value considered (ppm)	Conforming
9:30. 30 minutes	<0.007	0.01	**YES**
13:00. 4 hours	<0.007	0.01	**YES**
17:00. 8 hours	<0.007	0.01	**YES**

To verify and validate the analytical results 2 blanks have been performed for each measurement day. In both cases, the determinations were found to be below the detection limits of the analytical method. Therefore, no prior pollution was detected in the analyzed samples.

3. CONCLUSIONS

Once the environmental samples of hydrogen peroxide and ozone have been performed, it may be concluded that the operation of air purification equipment ECO FRESH AIR QUEST does not alter the concentration levels of these pollutants.

The results obtained before start-up of the equipment under study and those obtained during its operation period in both cases are below the detection limits of each of the analytical techniques and, therefore, below the limits considered more restrictive to environmental exposure. The FRESH AIR by Ecoquest can therefore be considered safe for indoor use, in the tested configuration.