

Indoor air quality study report :

ARTELIA - Morangis



Operation from 28 January to 04 February 2025

For :
ARTELIA

Site :
House in Morangis
18 rue Jules Hardouin Mansart, 91420
MORANGIS

Report n° ERP_2501040_R1_V1

Version number	Editorial	Proofreading	Validation
1	Léa QUELLARD	Thomas JACQUARD	Maureen BINET
	28/02/2025	04/03/2025	04/03/2025

contact@ispira.fr

Head Office: Campus ARTEPARC, 595 Rue Pierre Berthier Bâtiment D - 13290 Aix-en-Provence - France
- 04 13 41 98 72

IDF branch: Immeuble Equinox, 19-23 All. de l'Europe 2nd floor, 92110 Clichy - +33 (0)1 80 88 98 54

Table of contents

1	Context	4
2	Sampling plan	5
3	Measurement methods	6
3.1	Particle measurement	6
3.2	Air sampling for microbiological analysis	6
3.3	Method for measuring TVOCs	7
3.4	Method for measuring formaldehyde	7
3.5	Nitrogen dioxide (NO ₂) method	7
3.6	Measurement of Carbon Dioxide (CO ₂), comfort parameters (Temperature and Relative Humidity) and Carbon Monoxide (CO)	8
3.6.1	Spot measurements	8
3.6.2	Continuous measurements	8
4	Guide and reference values	9
4.1	Particulate concentration	9
4.2	Aerobiocontamination parameters	11
4.3	Total Volatile Organic Compounds (TVOCs)	11
4.4	Benzene	12
4.5	Formaldehyde	12
4.6	Nitrogen dioxide (NO ₂)	13
4.7	Carbon dioxide	13
4.8	Carbon monoxide (CO)	13
5	Measurement results	15
5.1	Particulate concentration	15
5.2	Microbiological enumerations	15
5.3	Volatile organic compounds (VOCs)	16
5.3.1	Total volatile organic compounds (TVOCs)	16
5.3.2	VOC screening	17
5.4	Benzene	18
5.5	Formaldehyde	19
5.6	Nitrogen dioxide (NO ₂)	19
5.7	Carbon monoxide (CO)	20
5.8	Comfort parameters: Carbon dioxide, temperature and relative humidity	20
5.8.1	Carbon dioxide (CO ₂)	20
5.8.2	Temperature and relative humidity	21

6	Conclusions	23
7	List of acronyms and abbreviations	24
8	Reference documents	24
9	Appendices	26
9.1	LAB'EAU laboratory microbiological analysis report	27
9.2	TERA laboratory chemical analysis report	30

List of figures

<i>Figure 1: Lighthouse optical particle counter</i>	6
<i>Figure 2: Aerobiocollector for air sampling for microbiological analyses</i>	6
<i>Figure 3: IAQ-Calc 7545 portable detector for measuring CO₂, T, RH and CO</i>	8
<i>Figure 4: Results of CO₂ measurements over the measurement period in the "RDC Lounge" area</i>	21
<i>Figure 5: Results of CO₂ measurements over the measurement period in the "Parents' bedroom R+1" area</i>	21
<i>Figure 6: Physiological comfort as a function of temperature and relative humidity</i>	22

List of tables

<i>Table 1: Sampling strategy</i>	5
<i>Table 2: Characteristics of the GilAir Plus pump</i>	7
<i>Table 3: Characteristics of the IAQ-Calc model 7545</i>	8
<i>Table 4: AirVisual Pro features</i>	8
<i>Table 5: Limit concentrations of particles 0.5, 1 and 5 µm for ISO class 9</i>	9
<i>Table 6: Reference limit concentrations for PM_{2.5} and PM₁₀ (WHO Air quality guidelines)</i>	10
<i>Table 7: Recommended limits for fungal counts</i>	11
<i>Table 8: Recommended limits for bacterial enumeration</i>	11
<i>Table 9: Distribution of bacterial counts (CFU/m³) in ventilated offices and outside buildings (according to standard XP X 43-401)</i>	11
<i>Table 10: ANSES VGAI and maximum permissible long-term value</i>	12
<i>Table 11: Summary of guide values for formaldehyde (HCSP and ANSES)</i>	12
<i>Table 12: Summary of guide values for nitrogen dioxide (ANSES)</i>	13
<i>Table 13: Guide values for carbon dioxide in indoor air</i>	13
<i>Table 14: Particulate measurement results - active sampling (Lighthouse)</i>	15
<i>Table 15: Results of microbiological sampling of ambient air</i>	15
<i>Table 16: Results of TVOC measurements - Active sampling</i>	16
<i>Table 17: Results of measurements of 10 VOCs - Active sampling</i>	17
<i>Table 18: Results of benzene measurements - Active sampling</i>	18
<i>Table 19: Results of formaldehyde measurements - Active sampling</i>	19
<i>Table 20: Results of nitrogen dioxide measurements - Active sampling</i>	19
<i>Table 21: Results of CO measurements over a period of approximately 15 minutes</i>	20
<i>Table 22: Results of CO₂ measurements</i>	20
<i>Table 23: Results of temperature and relative humidity measurements</i>	22

1 Context

As part of an audit of indoor air quality in a house, **ARTELIA** commissioned ISPIRA to carry out air quality checks in two areas of a house in Morangis.

The objectives of this measurement campaign were to quantify the physical, chemical and microbiological parameters of the indoor air before and after renovation of the house. This report presents the results of the pre-renovation campaign.

Several parameters were investigated in order to obtain a global approach to indoor air quality:

- Particulate contamination (PM_{2.5}) and particle counting
- Enumeration of bacterial flora
- Enumeration of fungal flora (yeasts and moulds)
- VOC index (Volatile Organic Compounds)
- Benzene
- Formaldehyde
- Nitrogen dioxide (NO₂)
- Carbon monoxide (CO)
- Carbon dioxide (CO₂)
- Comfort parameters (temperature and humidity)

All the samples and readings were taken between 28 January and 04 February 2025.

2 Sampling plan

The audit carried out by ISPIRA is based on **standard XP-X 43-401**, relating to air quality audits in non-industrial premises - office buildings and similar premises. The sampling plan was validated with **ARTELIA**.

The measurement points are as follows:

- 1 external consultant
- 2 interior points

The parameters measured are detailed in Table 1.

Table 1: Sampling strategy

Location	Parameters measured							
	Particles	Aerobiological contamination	COVT	Benzene	Formaldehyde	NO ₂	CO	T, HR and CO ₂ Continuous
Outdoor - Terrace	X	X	X	X		X	X	X
Ground floor lounge	X	X	X	X	X	X	X	X
Parents' bedroom R+1	X	X	X	X	X	X	X	X

Details of the sampling plan and photos of the sampling campaign are shown in the attached tables.

3 Methods of measurement

3.1 Measurement of particles

Particles were counted using a Lighthouse Handheld 3016-IAQ particle counter at a flow rate of 2.8 L/min. This is a portable optical detector (laser nephelometer). It uses laser beam scattering technology to determine the concentration of fine particles over 6 size ranges: $\geq 0.5 \mu\text{m}$, $\geq 1 \mu\text{m}$, $\geq 5 \mu\text{m}$, $\text{PM}_{2.5}$ and PM_{10} . The sampled air is continuously drawn into the device by a pump at a microprocessor-controlled flow rate. The intensity of the beam scattered by the dust particles is converted into an electrical signal that is proportional to the dust concentration. It allows immediate analysis with direct reading and data recording. The device complies with the following standards FS- 209E, ISO-14644-1 & EU GMP.



Figure 1: Lighthouse optical particle counter

3.2 Samples for microbiological analysis in the air

Contaminants are measured by dynamic sampling using an AIR IDEAL aerobiocollector (ISO 14698-1 accredited). For each point, a volume of 100 litres of air is sampled. The techniques used for sampling and analysing micro-organisms only provide an approximate value of the actual airborne contamination, as they only reveal viable and cultivable micro-organisms.

Samples are taken on Petri dishes pre-cast with a culture medium specific to the microbial populations under investigation. The sampled Petri dishes are then incubated. The colonies obtained are then counted on each plate by visual counting. The results are expressed as Colony Forming Units per $\text{m}^{(3)}$ of air sampled ($\text{CFU}/\text{m}^{(3)}$).



Figure 2: Aerobiocollector for air sampling for microbiological analyses

For the enumeration of aerobic microorganisms at 30°C, a PCA (Plate Count Agar) medium is used in accordance with standard NF EN ISO 4833-1. PCA is an inhibitor-free nutrient medium that promotes the growth of all microorganisms at 30°C.

For the enumeration of yeasts and moulds at 25°C, a Sabouraud YGC (Yeast Glucose Chloramphenicol) medium is used in accordance with standard NF V08-059. Yeast and mould growth is encouraged by the nutrients provided by yeast extract and glucose. The presence of chloramphenicol inhibits the growth of contaminating bacteria.

3.3 Method for measuring TVOC

Volatile Organic Compounds (VOCs) are measured using a GILAIR Plus low-flow pump. The pump is topped by an adsorbent tube, which is then thermally desorbed. Samples were taken for 6 hours at a flow rate of 0.1 L/min. Analysis is carried out in the laboratory using gas chromatography with MS or MS-FID detection. Sampling and analysis comply with ISO 16000-6.

Table 2: Characteristics of the GilAir Plus pump

Weight	581 g
Dimensions	10.9 x 6.1 x 6.1 cm
Autonomy	Approximately 8 hours, also works on sector
Flow rate range	20 - 499 cc/min or 0.02 - 5 L/min

3.4 Method for measuring formaldehyde

Formaldehyde is measured using a GILAIR Plus low-flow pump. The pump is topped by a cartridge impregnated with 2,4-dinitrophenylhydrazine (DNPH). Sampling was carried out for 6 hours at a flow rate of 0.5 L/min. Analysis was carried out using high-performance liquid chromatography (HPLC) coupled to an ultraviolet absorption detector. Sampling and analysis comply with the ISO 16000-3 standard.

3.5 Nitrogen dioxide method (NO₂)

Nitrogen dioxide is measured using a GILAIR Plus low-flow pump. The pump is topped by an impregnated support (SKC tube). The sample is then analysed by visible spectrometry.

3.6 Measurement of carbon dioxide (CO₂), comfort parameters (temperature and relative humidity) and carbon monoxide (CO)

3.6.1 Measurements

Confinement (CO₂), comfort parameters and carbon monoxide (CO) are measured at intervals using an IAQ-Calc 7545 sensor for around twenty minutes at respiratory tract level.

The following table shows the characteristics of the IAQ-Calc 7545 :

Table 3: Characteristics of the IAQ-Calc model 7545

	CO ₂	Temperature	Relative humidity	CO
Detection method	Double-length NDIR (non dispersive)	Thermistor	Thin-film capacitive sensor	Model 982 electrochemical sensor
Range of measure	0 - 5000 ppm	0 to 60°C	5 à 95%	0 to 500 ppm
Precision	+/- 3% of reading or +/- 50 ppm, whichever is greater high	+/- 0,5°C	+/- 3%	+/- 3% of reading or +/- 3 ppm
Resolution	1 ppm	0,1 °C	0,1%	0.1 ppm



Figure 3: IAQ-Calc 7545 portable detector for measuring CO₂, T, RH and CO

3.6.2 Measurements

Carbon dioxide (CO₂) and comfort parameters are measured continuously using AirVisual Pro devices. The following table shows the characteristics of AirVisual Pro devices.

Table 4: AirVisual Pro features

Features	
Carbon dioxide	
Detection method/sensor type	Non-destructive infrared absorption spectrometry dispersive (NDIR)

Range of measurements	400 - 10 000 ppm
Resolution	1 ppm
Temperature	
Detection method/sensor type	CMOS
Range of measurements	-10°C - 40°C
Resolution	0,1°C
Humidity	
Detection method/sensor type	Capacitive
Range of measurements	0 - 100 %
Resolution	1 %



Figure 5: AirVisual Pro, a device for continuously measuring comfort parameters

4 Guide and reference values

The results presented in chapter 6 will be compared with the reference guide values, specific to each compound or parameter studied, described below.

4.1 Concentration particulate

➤ Indoor air

The results of particle counts with an aerodynamic diameter of 0.5 µm, 1 µm and 5 µm are recorded and compared with the concentration limits in standard NF EN ISO 14644-1, applicable to cleanrooms and other associated buildings (ISO class 9 and ISO class 8).

Table 5: Particle concentration limits 0.5, 1 and 5 µm for ISO class 9

Particulate class	≥ 0.5 µm	≥ 1 µm	≥ 5 µm
Concentration limits (particles/L of air) ISO 9	35 200	8 320	293
Concentration limits (particles/L of air) ISO 8	3 520	832	29,3

The reference guide values established by the WHO (Air quality guidelines) and recommended by ANSES are as follows:

Table 6: Reference limit concentrations for PM_{2.5} and PM₁₀ (WHO Air quality guidelines)

Particulate class	PM _{2.5}	PM ₁₀
Chronic exposure (year)	5 µg.m⁻³ (3)	15 µg.m⁻³ (3)
24-hour exhibition	15 µg.m⁻³ (3)	45 µg.m⁻³ (3)

➤ ISO 16890 standard

The new ISO 16890 standard replaces NF EN 13779:2012 from 2018.

This standard uses particle sizes between 0.3 and 10 microns to define filter efficiencies, whereas EN 779:2012 used only 0.4 micron particles. The efficiencies for the different particle sizes (PM1, PM2.5 and PM10) are measured on statically charged and discharged filters. The method, which is stricter than before, provides a more accurate indication of the efficiency of synthetic media filters.

The new ISO 16890 standard divides air filters into four groups. The standard requires a filter to have a minimum efficiency of 50%, depending on the particle size targeted. For example, if a filter retains more than 50% of PM1 particles, it will be classified as an ISO ePM1 filter. Its efficiency is then reported, grouped in 5% increments. In addition to fine particles, the new ISO standard also assesses coarse dust filters such as ISO coarse: i.e. filters that retain less than 50% of PM10.

Groupe	Efficacité	Type de particules filtrées
ISO ePM1	ePM1, min > 50%	Virus, nanoparticules, gaz d'échappement
ISO ePM2.5	ePM2.5, min > 50%	Bactéries, champignons et spores de moisissures, pollen, poussières de toner
ISO ePM10	ePM10 > 50%	Pollen, poussière de désert
ISO grossier	ePM10 < 50%	Sable, cheveux

In order to compare the filter classes between these two standards, the following table gives an example of equivalences:

Classe	ISO ePM1	ISO ePM2.5	ISO ePM10	ISO grossier
G3	-	-	-	> 80%
G4	-	-	-	> 90%
M5	-	-	> 50%	-
M6	-	50-65 %	> 60%	-
F7	50-65 %	65-80%	> 85%	-
F8	65-80%	> 80%	> 90%	-
F9	> 80%	> 95%	> 95%	-

4.2 Parameters of aerobiocontamination

The limits recommended by ASPEC are shown in the tables below: Fungal flora (yeasts + moulds) :

Table 7: Recommended limits for fungal counts

	Ventilated buildings	Non-ventilated buildings (unfiltered incoming air)
Recommended limits for values obtained (CFU/m³)	<100	<1000

Bacterial flora :

Table 8: Recommended limits for bacterial enumeration

	Ventilated or non-ventilated buildings
Recommended limits for the values obtained (CFU/m³)	<1000

The values obtained can also be compared with those usually found in ventilated offices, presented in the appendix to standard XP X43-401: (Air quality - Audit of air quality in non-industrial premises - Office buildings and similar premises):

Table 9: Distribution of bacterial counts (CFU/m³) in ventilated offices and outside buildings (according to standard XP X43-401)

	Bacterial counts (CFU/m ³)	
	Ventilated offices	Exterior
Percentile 5	95	25
Percentile 50	320	70
95 percentile	1020	281
Maximum	3150	860
Minimum	15	15

4.3 Total Volatile Organic Compounds (TVOCs)

The VOC or total VOC (TVOC) index values are compared with the volatile organic load thresholds defined by the German Federal Environment Agency (2007).

- ≤ 300 µg/m³**: comfort target value
- > 300 - 1,000 µg/m³**: no specific impact, but increased ventilation recommended
- > 1,000 - 3,000 µg/m³**: search for sources, increase ventilation
- > 3,000 - 10,000 µg/m³**: major impacts
- > 10,000 µg/m³**: unacceptable situation

4.4 Benzene

The ANSES VGAI is **2 $\mu\text{g}/\text{m}^3$** . Levels below or equal to this indicate good air quality with regard to this pollutant, but it should be borne in mind that benzene is a carcinogen with no safety threshold, and that the aim should always be to reduce concentrations to as low a level as reasonably achievable.

10 $\mu\text{g}/\text{m}^3$ is a rapid action value above which the sources in question must be rapidly identified and neutralised in order to bring indoor levels below the target value of 2 $\mu\text{g}/\text{m}^3$. A compliance period of a few weeks to a few months is allowed, since the aim is to protect against a long-term effect.

Table 10: ANSES VGAI and maximum permissible long-term value.

Compound	VGAI ANSES	Maximum permissible value on the Long-term HCSP
	$\mu\text{g}/\text{m}^3$	
Benzene	2	10

4.5 Formaldehyde

The concentrations measured, in the form of an integrated average value over 5 days, are compared with the benchmark values for air management in enclosed spaces, recommended by the Haut Conseil de la Santé Publique (2009) and with the Indoor Air Quality Guide Values (IAQGV), defined by Anses.

- **30 $\mu\text{g}/\text{m}^3$** is the air quality guide value "below which, in 2018, a building can be considered to be of good quality". This value corresponds to :

- Guide value proposed in Decree no. 2011-1727 of 2 December 2011 on indoor air guide values for formaldehyde and benzene (for long-term exposure).
- HCSP benchmark value for air quality.

- **50 $\mu\text{g}/\text{m}^3$** is the HCSP's maximum permissible value (MPV) for long-term exposure. Above 50 $\mu\text{g}/\text{m}^3$, occupants must be informed and, within a few months, the main source(s) must be identified and reduced by taking appropriate action.

- A level in excess of **100 $\mu\text{g}/\text{m}^3$** must lead to "prompt corrective action within one month of the result". This concentration corresponds to :

- Limit value of the Decree of 30 December 2015
- ANSES VGAI

Table 11: Summary of guide values for formaldehyde (HCSP and ANSES)

Compound	Long-term exposure		
	HCSP benchmark value	HCSP VMA	HCSP limit value
	$\mu\text{g}/\text{m}^3$		
Formaldehyde	30	50	100

4.6 Nitrogen dioxide (NO₂)

The concentrations measured will be compared with the following reference values:

- Limit value under French and European regulations (2021) for one year's exposure: 40 µg/m³,
- ANSES 2013 VGAI for a one-year exposure: 20 µg/m³,
- ANSES 2013 VGAI for a 1-hour exposure: 200 µg/m³.

Table 12: Summary of guide values for nitrogen dioxide (ANSES)

Compound	VGAI ANSES (>1 year)	Limit value (>1 year)	VGAI ANSES (1h)
	µg/m ³		
Nitrogen dioxide	20	40	200

4.7 Carbon dioxide

The reference values for carbon dioxide are as follows:

Table 13: Guide values for carbon dioxide in indoor air

GUIDE VALUES (ppm: parts per million)	REFERENCES
800 ppm	Covid HCSP recommended value
1000 ppm 1,300 ppm (tolerated for non-smoking premises)	Standard Departmental Health Regulations (Circular dated 24/08/1978)
Minimum fresh air rate for office spaces : → 25 m ³ /h/occupant (eq. 1000 ppm) Minimum fresh air rate for meeting rooms and catering areas : → 30 m ³ /h/occupant	French Labour Code Article R.4222-6
1700 ppm ICONE Index	Environment Code (ERP)

4.8 Carbon monoxide (CO)

Carbon monoxide is classified in category 1 of substances toxic to reproduction (European classification). It is therefore subject to the provisions of articles R. 4412- 59 to R. 4412-93 of the French Labour Code, relating to the risks of exposure to CMR substances applicable in establishments presenting such risks, and to article D. 4152-10 of the Labour Code relating to special provisions for pregnant and breast-feeding women.

According to the document published in May 2007 by the Observatoire de la Qualité de l'Air Intérieur (OQAI): The "National Housing Campaign - State of air quality in French homes". The aim is to check for any malfunctions in combustion appliances.

The indoor air guide values recommended by Anses (2007) are :

- **10 mg/m³** for 8-hour exposure

- 30 mg/m³ for a one-hour exposure
- 60 mg/m³ for 30-minute exposure
- 100 mg/m³ for 15-minute exposure

Diagnosis of the installations is recommended if the concentration is greater than 10 mg/m³ for more than one minute.

5 Results of measurements

The results of the study are developed in this chapter.

5.1 Concentration particulate

The results for particulate matter are shown in the table below:

Table 14: Particulate measurement results - active sampling (Lighthouse)

Location	$\geq 0.5 \mu\text{m}$	$\geq 1 \mu\text{m}$	$\geq 5 \mu\text{m}$	PM _{2.5}	PM ₁₀
	Counting (number of particles/L)			$\mu\text{g}/\text{m}^3$	
Outside Terrace	7522	3110	58	23,2	36,3
Ground floor lounge	4829	1811	76	13,7	26,1
Parents' bedroom R+1	2572	869	85	6,4	18,3
	$\geq 0.5 \mu\text{m}$	$\geq 1 \mu\text{m}$	$\geq 5 \mu\text{m}$	PM _{2.5}	PM ₁₀
ISO9 limit	35 200	8 320	293		
ISO8 limit	3 520	832	29,3		
WHO guide values (1 year)				5	15
WHO guide values (24 h)				15	45

Concentrations of particles greater than 0.5 and 1 μm belong to ISO class 8 or ISO 9 according to ISO standard 14 644-1 on the classification of clean rooms and other related controlled environments. This dust level is satisfactory for a house.

The average concentrations of PM_{2.5} and PM₁₀ measured comply with the WHO's 24-hour guide values and remain below the levels recorded in outdoor air at the two measurement points.

No abnormal accumulation of particles was detected.

5.2 Enumeration microbiological

The results of the microbiological enumerations, carried out by the LAB'EAU laboratory, are presented below.

Table 15: Results of microbiological sampling of ambient air

Location	Yeast	Mould
	*CFU/m ³	
Outside Terrace	<10	251
Ground floor lounge	<10	102
Parents' bedroom R+1	<10	71
Recommended limit (CFU/m ³)	1000	

*The corrected concentrations are calculated according to the correction and conversion table supplied by the manufacturer of the AIR IDEAL aerobiocollector or the SAMPLAIR LITE (depending on the device used).

➤ Indoor air

The concentrations of fungal flora were below the recommended limits and the external reference for the two areas investigated. No accumulation of fungal flora was detected.

5.3 Volatile organic compounds (VOCs)

5.3.1 Total volatile organic compounds (TVOCs)

The results for TVOCs are presented in the table below. The full results from the laboratory can be found in the appendix.

Table 16: Results of TVOC measurements - Active sampling

Location	Concentration	Comfort target value
	$\mu\text{g}/\text{m}^3$	
Outside Terrace	2,8	300
Ground floor lounge	257	
Parents' bedroom R+1	235	

*Concentration calculated as toluene equivalent

The concentrations of TVOCs recorded are higher than the outdoor benchmark, b u t remain **below the level 1 threshold of $300 \mu\text{g}/\text{m}^3$ recommended by the German Federal Environment Agency.**

No health risks linked to this parameter have been identified.

5.3.2 Screening VOC

The results for the 10 most prevalent VOCs are shown in the table below. The full results from the laboratory can be found in the appendix.

Table 17: Results of measurements of 10 VOCs - Active sampling

Compound	Concentration			VGAI ¹	TRV ²	VLEP ³
	$\mu\text{g}/\text{m}^3$			$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$
	Outside Terrace	Ground floor lounge	Parental room e			
Dimethyl ether	0,08	2,1	22,8	–	–	1 920 000
Butane	<LQ (=0.06)	5,3	15,4	–	–	1 900 000
Ethanol	0,17	2,3	98,8	–	–	1 900 000
Acetonitrile	<LQ (=0.06)	35,6	81,8	–	–	70 000
Cyclotrisiloxane, hexamethyl-	0,43	5,6	4,5	–	–	–
Heptane, 2,2,4,6,6-pentamethyl-	0,98	27,5	19,5	–	–	–
Limonene	<LQ (=0.06)	99,7	67,8	–	–	–
7-Octen-2-ol, 2,6-dimethyl-	<LQ (=0.06)	7,3	2,1	–	–	–
Undecane	<LQ (=0.06)	12,6	11,3	–	–	–
3-Octanol, 3,7-dimethyl-	<LQ (=0.06)	5,2	1,4	–	–	–
Linalool	<LQ (=0.06)	5,5	0,54	–	–	–
Cyclopentasiloxane, decamethyl-	<LQ (=0.06)	5,4	4,3	–	6400	–
Nonanal	<LQ (=0.06)	4,5	1,7	–	–	–
Oxygenated compound of the C ₁₂ H ₂₀ O ₂ unidentified	<LQ (=0.06)	13,6	11,3	–	–	–
Oxygenated compound of the C ₁₂ H ₂₀ O ₂ unidentified	<LQ (=0.06)	5,7	2,6	–	–	–
Dodecane, 2,6,10-trimethyl-	<LQ (=0.06)	19,8	21,3	–	–	–
4-tert-Butylcyclohexyl acetate	<LQ (=0.06)	5,4	4,4	–	–	–
Siloxane compound unidentified	<LQ (=0.06)	6,5	4,1	–	–	–
Non-oxygenated compound identified >C ₁₂	<LQ (=0.06)	5,8	4,9	–	–	–

¹VGAI - long term - Indoor Air Guide Value (decree no. 2011-1727 of 02/12/2011)

²TRV - Toxicological Reference Value

³VLEP - Occupational Exposure Limit Value

Unidentified oxygen compound
>C13

<LQ (=0.06)

5,4

5,7

–

–

–

* LQ: Laboratory Quantification Limit

Analyses carried out in the living room revealed the presence of several compounds, including acetonitrile, limonene, heptane (2,2,4,6,6-pentamethyl-), undecane, an unidentified oxygen compound with the formula $C_{12}H_{20}O_2$, and dodecane (2,6,10-trimethyl-). As this room is frequently exposed to cleaning products, air fresheners and furniture treated with varnishes or glues, these substances can accumulate. The use of scented candles, air fresheners and smoking may also explain their presence.

In the parents' bedroom, the main compounds detected were dimethyl ether, butane, ethanol, acetonitrile, heptane (2,2,4,6,6-pentamethyl-), limonene, undecane, an unidentified oxygen compound of formula $C_{12}H_{20}O_2$ and dodecane (2,6,10-trimethyl-). The common use of care and hygiene products (perfumes, deodorants, creams, hairsprays) contributes to the presence of some of these compounds. In addition, the use of deodorant sprays or scented candles may explain the high concentration of limonene and ethanol, while the detection of butane and dimethyl ether indicates frequent use of aerosols.

These substances mainly come from domestic activities and the materials present in rooms, thus influencing indoor air quality. Regular ventilation helps to limit their accumulation and improve indoor air quality.

All the compounds found remain well below existing reference values, and no health risk has been identified.

5.4 Benzene

The results for benzene are shown in the table below. The full results from the laboratory can be found in the appendix.

Table 18: Results of benzene measurements - Active sampling

Location	Concentration	VGAI ANSES
	$\mu\text{g}/\text{m}^3$	
Outside Terrace	0,7	2
Ground floor lounge	1,0	
Parents' bedroom R+1	0,7	

*LQ: Laboratory Quantification Limit

The concentrations of benzene found in the instrumented spaces are below the reference guide value of $2 \mu\text{g}/\text{m}^3$ defined by ANSES, and of the same order of magnitude as that measured in outdoor air.

No abnormal accumulation of this compound was identified.

5.5 Formaldehyde

The results for formaldehyde are shown in the table below. The full results from the laboratory can be found in the appendix.

Table 19: Results of formaldehyde measurements - Active sampling

Location	Concentration	HCSP benchmark value
	$\mu\text{g}/\text{m}^3$	
Ground floor lounge	21,9	30
Parents' bedroom R+1	18,6	

*LQ: Laboratory Quantification Limit

Formaldehyde concentrations in the two areas investigated were below the benchmark value of 30 $\mu\text{g}/\text{m}^3$.

No abnormal accumulation of this compound was identified.

5.6 Nitrogen dioxide (NO₂)

The results for NO₂ are presented in the table below. The full results from the laboratory can be found in the appendix.

Table 20: Results of nitrogen dioxide measurements - Active sampling

Location	Concentration	ANSES VGAI
	$\mu\text{g}/\text{m}^3$	
Outside Terrace	22,0	20
Ground floor lounge	17,2	
Parents' bedroom R+1	14,7	

* LQ: Limit of quantification

Concentrations of nitrogen dioxide were below the ANSES guide value at both measurement points.

No abnormal accumulation of this compound was identified.

5.7 Carbon monoxide (CO)

Table 21: Results of CO measurements over a period of approximately 15 minutes

Location	Concentration	ANSES guide value
	ppm	
Outside Terrace	2,2	8,7
Ground floor lounge	1,7	
Parents' bedroom R+1	2,8	

*Sensor detection limit for CO, LD=0.1 ppm

CO measurements are satisfactory and well below the ANSES guide value.

5.8 Comfort parameters: Carbon dioxide, temperature and relative humidity

5.8.1 Carbon dioxide (CO₂)

The concentrations measured are shown in the table below.

Table 22: Results of CO₂ measurements

Location	Maximum (CO ₂)	Average (CO ₂)	HCSP guide value
	ppm		
Outside Terrace	516	429	800
Ground floor lounge	1552	951	
Parents' bedroom R+1	1415	825	

The average CO₂ concentrations measured in the areas investigated were higher than the HCSP guide value (800 ppm) during the measurement campaign. Frequent exceedances were recorded, particularly in the morning and evening, due to the human presence at these times of day. The graphs below illustrate these exceedances:

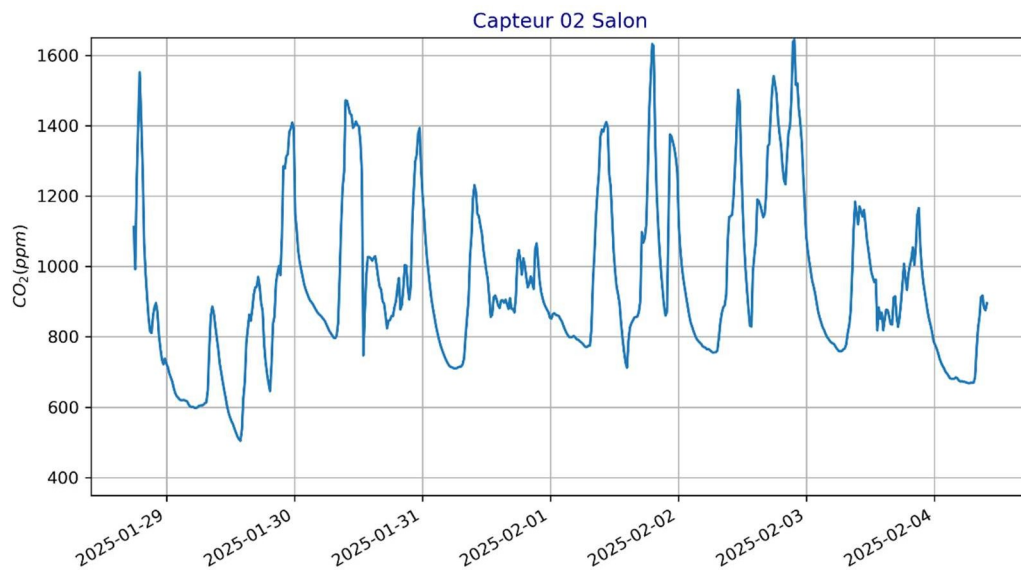


Figure 4: Results of CO_2 measurements over the measurement period in the "RDC Lounge" area

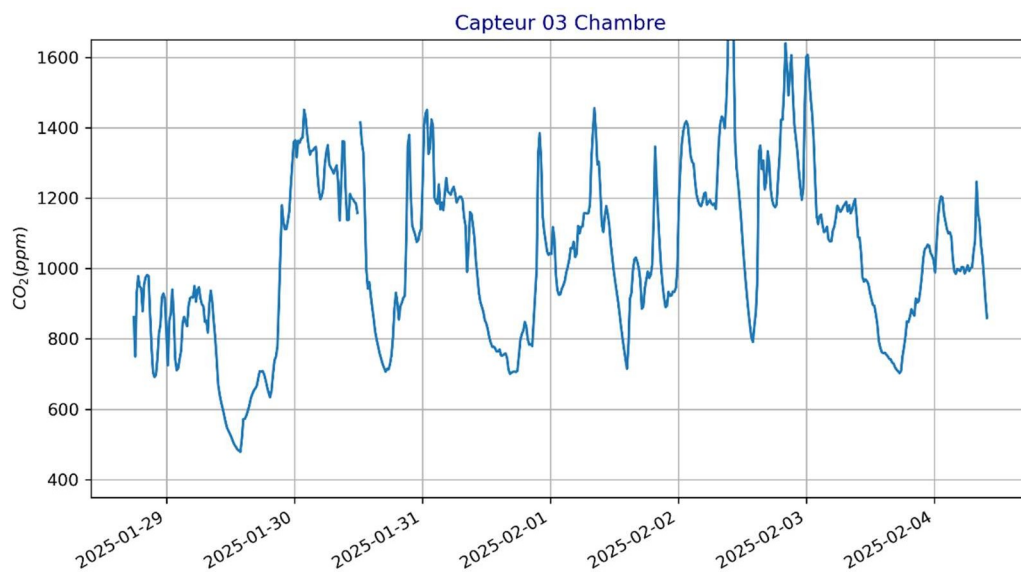


Figure 5: Results of CO_2 measurements over the measurement period in the "Parents' bedroom R+1" area

Nevertheless, these exceedances are logical in a home with no mechanical ventilation. The concentrations measured are rarely extreme (>1500 ppm) and remain on average below 1000 ppm, which is satisfactory for this type of space.

During the period of occupancy, it is advisable to maintain frequent ventilation by opening the windows.

5.8.2 Temperature and humidity

For relative humidity and temperature, the averages calculated over the periods when the premises were occupied are summarised in the table and graph below.

Table 23: Results of temperature and relative humidity measurements

Location	Temperature	Relative humidity
	°C	%
Outside Terrace	14,1	61
Ground floor lounge	21,4	55
Parents' bedroom R+1	20,8	55

The graph below shows the comfort zone of the instrumented space, as a function of temperature and humidity.

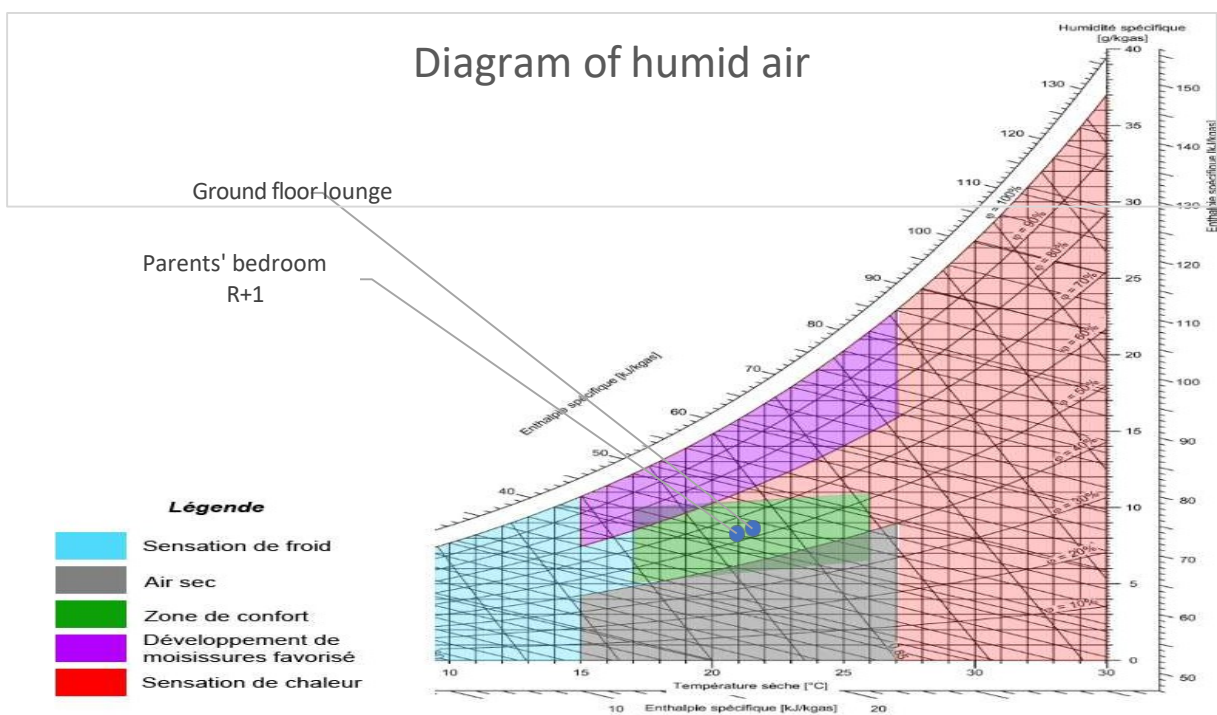


Figure 6: Physiological comfort as a function of temperature and relative humidity

The temperature and relative humidity parameters are within the comfort zone for the two spaces investigated.

According to the OQAI, relative humidity should be between **40 and 70%**, and temperature between 18 and 22°C, for optimum comfort.

Note that relative humidity above 60% can encourage mould growth.

6 Conclusions

The measurement campaign highlighted the following points:

- The average concentrations of PM_{2.5} and PM₁₀ measured comply with the WHO's 24-hour guide values and remain below the levels recorded in outdoor air at the two measurement points.
- The concentrations of fungal flora were below the recommended limits and the external reference for the two areas investigated.
- For the different spaces investigated, all the chemical parameters (TVOC, benzene, formaldehyde, nitrogen dioxide (NO₂) and carbon monoxide (CO)) are present at satisfactory levels inside the building.
- The volatile organic compounds most commonly found in the home come from domestic activities and the materials used in the rooms, thus influencing indoor air quality. Regular ventilation would limit their accumulation and improve indoor air quality. All the compounds found remain well below existing reference values, and no health risk has been identified.
- For carbon dioxide, the HCSP guide value of 800 ppm was exceeded on average over the week of measurements. Nevertheless, these exceedances are logical in a home with no mechanical ventilation. The concentrations measured were rarely extreme (>1500 ppm) and remained below 1000 ppm on average, which is satisfactory for this type of space.
- Finally, the temperature and relative humidity parameters are within the comfort zone for the two spaces investigated.

In view of the results, air quality in the house was generally satisfactory during the measurement period.

7 List of acronyms and abbreviations

ANSES: Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail VOC:

Volatile Organic Compounds

CO: Carbon monoxide

CSHPPF: Conseil Supérieur d'Hygiène Publique de France HCSP:

Haut Conseil de Santé Publique (French High Council for Public Health)

LQ: Limit of Quantification

OEHHA: Bureau de l'évaluation des risques pour la santé liée à l'environnement VGAI:

Valeur guide de l'air intérieur (Guide value for indoor air)

TRV: Toxicological reference value

OQAI: Observatoire de la qualité de l'air intérieur (Indoor Air Quality Observatory) WHO: World Health

Organisation

HPLC: High Performance Liquid Chromatography UV: Ultra-Violet

PM: Particulate Matter

CFU: Colony forming unit

ASPEC: Association for the Prevention and Study of Contamination

8 Documents reference

- Standard NF ISO 16000-18: Indoor air - Part 18: Detection and enumeration of moulds.
- Impaction sampling Standard NF ISO 16000-17: Indoor air - Part 17: Detection and enumeration of moulds - Culture method
- Norme XP X43-401 : Qualité de l'air - Audit de la qualité de l'air dans les locaux non industriels - Bâtiments à usage de bureaux et locaux similaires
- Opinion of Anses - collective expertise report "Moulds in buildings" June 2016
- Standard NF EN ISO 14698-1 : Cleanrooms and associated controlled environments - Biocontamination control - Part 1 : General principles and methods Standard NF EN ISO 14698-1 : Cleanrooms and associated controlled environments - Biocontamination control - Part 2 : Evaluation and interpretation of biocontamination data
- Norme XP X43-401 : Qualité de l'air - Audit de la qualité de l'air dans les locaux non industriels - Bâtiments à usage de bureaux et locaux similaires
- NF ISO 16000-4 April 2006 (Indoor air, Part 4: Determination of formaldehyde - Diffusive sampling method).
- FS 209E and ISO 14644 Cleanroom Classification Standards

- ISO 14698-1, September 2003 - Cleanrooms and associated controlled environments - Biocontamination control - Part 1: General principles and methods
- NF EN ISO 4833-1, October 2013 - Microbiology of food - Horizontal method for the enumeration of micro-organisms - Part 1: colony count at 30 °C by the deep plating technique
- NF V08-059, November 2002 - Food microbiology - Enumeration of yeasts and moulds by colony counting at 25° C - Routine method
- NF EN ISO 6888-1, October 1999 - Microbiology of food - Horizontal method for the enumeration of coagulase-positive staphylococci (*Staphylococcus aureus* and other species) - Part 1: technique using Baird-Parker agar medium
- NF EN ISO 21150 February 2016 : Cosmetics - Microbiology - Detection of *Escherichia coli*
- Indoor Air Quality Guide Values (IAQGV) - ANSES
- WHO guide values for indoor air quality
- Recommendations of the Conseil Supérieur d'Hygiène Public de France 07/1993
- Indoor air quality and comfort in office buildings, December 2014: bulletin from the Indoor Air Quality Observatory (OQAI) No. 8
- Benchmark values to help manage indoor air quality, 13 October 2009 - Haut conseil de la santé publique (French public health council)
- ISO 14644-1: 2015 - Cleanrooms and associated controlled environments - Part 1: Classification of air particulate cleanliness
- XP X43-401 (Air quality - Audit of air quality in non-industrial premises - Office buildings and similar premises)
- French Labour Code Article R.4222-6
- Decree no. 2012-14 of 05/01/2012
- Guide Pratique -Gestion de la qualité de l'air intérieur - Institut de Veille Sanitaire, 2010.
- Decrees 84-1093 and 1094 of 07 December 1984 and the orders of 8 and 9 October 1987 on the ventilation and sanitation of workplaces with specific and non-specific pollution.

9 Appendices

1. LAB'EAU laboratory microbiological analysis report
2. TERA laboratory chemical analysis report

9.1 Microbiological analysis report from the laboratory LAB'EAU



Laboratoire d'analyses d'eau, d'air et de surfaces
2 Sites : 43, rue des Arts 82000 Montauban
90, rue Nicolas Chédeville 34070 Montpellier
Siret 42985934100027/35 - APE 7120B
www.lab-eau.com - Tel : 05.63.222.960 - info@lab-eau.com

RAPPORT d'ANALYSES

Le 05-02-2025 à 09:44
Référence dossier : A250203019

ISPIRA
6, rue des Bateliers
92110 CLICHY

Caractéristique de l'échantillon - informations laboratoire :

Date de réception : 31-01-2025	Date de début d'analyse : 31-01-2025
Informations client :	
Lieu de prélèvement : Nexans commande : C0002286 Date et heure de prélèvement : 28-01-2025 Point de prélèvement : extérieur	Prélèvement effectué par : le demandeur Nature de l'échantillon : air (Sabouraud uniquement)

Microbiologie :

Point de prélèvement : extérieur	Numération en UFC par boîte Résultats
Flore totale	UFC/boîte -dont Staphylocoque pathogène : -dont Entérobactérie : -dont moisissure :
Flore Fongique	24 UFC/boîte -dont levure : 0 -dont moisissure : 24 dont <i>Aspergillus sp.</i> : 0

Analyse selon MOD-MICR-015. Les boîtes de prélèvement sont incubées à 30°C durant 5 jours. Les résultats ne valent que pour l'échantillon soumis à essai. Les résultats ne peuvent donc valoir pour un lot ou un ensemble. Seule la reproduction intégrale de ce rapport est autorisée par le laboratoire. Le laboratoire s'exonère de sa responsabilité pour toutes les informations données par le client qui peuvent affecter la validité des résultats.

Signataire : Hélène Blanc Resp. technique

H. Blanc
Responsable technique

JF. Laran
Biologiste

JL. Galinier
Biologiste

R. Blanc
Ingénieur Environnement

Page 1 / 1



Laboratoire d'analyses d'eau, d'air et de surfaces
2 Sites : 43, rue des Arts 82000 Montauban
90, rue Nicolas Chêdeville 34070 Montpellier
Siret 42985934100027/35 – APE 7120B
www.lab-eau.com – Tel : 05.63.222.960 – info@lab-eau.com

RAPPORT d'ANALYSES

ISPIRA

Le 05-02-2025 à 09:45
Référence dossier : A250203020

6, rue des Bateliers
92110 CLICHY

Caractéristique de l'échantillon – informations laboratoire :

Date de réception : 31-01-2025	Date de début d'analyse : 31-01-2025
--------------------------------	--------------------------------------

Informations client :

Lieu de prélèvement : Nexans commande : C0002286 Date et heure de prélèvement : 28-01-2025 Point de prélèvement : salon RDC	Prélèvement effectué par : le demandeur Nature de l'échantillon : air (Sabouraud uniquement)
--	---

Microbiologie :

Point de prélèvement : salon RDC	Numération en UFC par boîte Résultats
Flore totale	UFC/boîte -dont Staphylocoque pathogène : -dont Entérobactérie : -dont moisissure :
Flore Fongique	10 UFC/boîte -dont levure : 0 -dont moisissure : 10 dont <i>Aspergillus sp.</i> : 0

Analyse selon MOD-MICR-015. Les boîtes de prélèvement sont incubées à 30°C durant 5 jours. Les résultats ne valent que pour l'échantillon soumis à essai. Les résultats ne peuvent donc valoir pour un lot ou un ensemble. Seule la reproduction intégrale de ce rapport est autorisée par le laboratoire. Le laboratoire s'exonère de sa responsabilité pour toutes les informations données par le client qui peuvent affecter la validité des résultats.

Signataire : Hélène Blanc Resp. technique

H. Blanc
Responsable technique

JF. Laran
Biologiste

JL. Galinier
Biologiste

R. Blanc
Ingénieur Environnement

Page 1 / 1



Laboratoire d'analyses d'eau, d'air et de surfaces
2 Sites : 43, rue des Arts 82000 Montauban
90, rue Nicolas Chêdeville 34070 Montpellier
Siret 42985934100027/35 - APE 7120B
www.lab-eau.com - Tel : 05.63.222.960 - info@lab-eau.com

RAPPORT d'ANALYSES

Le 05-02-2025 à 09:46
Référence dossier : A250203021

ISPIRA
6, rue des Bateliers
92110 CLICHY

Caractéristique de l'échantillon – informations laboratoire :

Date de réception : 31-01-2025	Date de début d'analyse : 31-01-2025
<i>Informations client :</i>	
Lieu de prélèvement : Nexans commande : C0002286 Date et heure de prélèvement : 28-01-2025 Point de prélèvement : chambre R+1	Prélèvement effectué par : le demandeur Nature de l'échantillon : air (Sabouraud uniquement)

Microbiologie :

Point de prélèvement : chambre R+1	Numération en UFC par boîte Résultats
Flore totale	UFC/boîte -dont Staphylocoque pathogène : -dont Entérobactérie : -dont moisissure :
Flore Fongique	7 UFC/boîte -dont levure : 0 -dont moisissure : 7 dont <i>Aspergillus</i> sp. : 0

Analyse selon MOD-MICR-015. Les boîtes de prélèvement sont incubées à 30°C durant 5 jours. Les résultats ne valent que pour l'échantillon soumis à essai. Les résultats ne peuvent donc valoir pour un lot ou un ensemble. Seule la reproduction intégrale de ce rapport est autorisée par le laboratoire. Le laboratoire s'exonère de sa responsabilité pour toutes les informations données par le client qui peuvent affecter la validité des résultats.

Signataire : Hélène Blanc Resp. technique

H. Blanc
Responsable technique

JF. Laran
Biologiste

JL. Galinier
Biologiste

R. Blanc
Ingénieur Environnement

Page 1 / 1

9.2 Chemical analysis report from the laboratory TERA



Affaire N° 25AF27968

Commande N° C0002271

Présentation générale

Affaire N°	25AF27968	Version du rapport :	0
Client :	ISPIRA	Référence client :	
Adresse :	19/21 Allée de l'Europe, 92110 CLICHY		
Commande client :	C0002271	Devis client :	25DE38794
Date de fin des prélèvements :	29/01/2025		
Date de réception des échantillons :	03/02/2025	Rapport transmis le :	17/02/2025
Réserve éventuelle :			

Les résultats ne se rapportent qu'aux objets soumis à l'essai. TERA Environnement n'est pas responsable des informations transmises par le client et se dégage de toute responsabilité relative aux durées, températures, volumes de prélèvement ou emplacements notamment. Les concentrations calculées ne sont donc jamais portées par l'accréditation et sont sujettes à caution. Pour les prélèvements passifs, si la température d'exposition n'est pas renseignée, elle sera considérée à 20°C par défaut. Les résultats s'appliquent aux échantillons tels qu'ils ont été reçus.

Les milieux sont spécifiés ainsi : AIA=Air ambiant / ALT=Air des Lieux de Travail / AGA=Gaz des sols -Emission-Air des lieux de travail / AEX=Air à l'émission / GDS=Gaz contenus dans les sols / Eau=Eaux / QAI = Qualité de l'air intérieur / HTS= Hautes technologies - Santé / LAR=LABREF30-ERP / DIV=Divers / SUR=Conta de surface / ADBLUE / CAP=Location de capteurs

Dans la suite du rapport, seuls les paramètres notés avec un (c) sont couverts par l'accréditation cofrac essais.

Présentation des échantillons - Nombre total d'échantillons : 8

Paramètres à analyser	Milieu	Références échantillons	Emplacement client	Air prélevé(L)
Dioxyde d'azote (NO2)	QAI	1983301393-SKC	SALON-RDC	35,577
Dioxyde d'azote (NO2)	QAI	1983301395-SKC	CHAMBRE PARENTALE R+1	35,579
Dioxyde d'azote (NO2)	QAI	1983301396-SKC	EXT-JARDIN	35,576
Screening 10 COV/s	QAI	TERA 20707-GAS	SALON-RDC	17,679
Benzène	QAI	TERA 20707-GAS	SALON-RDC	17,679
COV totaux	QAI	TERA 20707-GAS	SALON-RDC	17,679
Screening 10 COV/s	QAI	TERA 20752 - GAS	CHAMBRE PARENTALE R+1	17,678
COV totaux	QAI	TERA 20752 - GAS	CHAMBRE PARENTALE R+1	17,678
Benzène	QAI	TERA 20752 - GAS	CHAMBRE PARENTALE R+1	17,678
Screening 10 COV/s	QAI	TERA 20753 - GAS	EXT-JARDIN	17,677
COV totaux	QAI	TERA 20753 - GAS	EXT-JARDIN	17,677
Benzène	QAI	TERA 20753 - GAS	EXT-JARDIN	17,677
Formaldéhyde -	QAI	DNPH-SALON RDC	SALON-RDC	178,362
Formaldéhyde -	QAI	DNPH-CHAMBRE	CHAMBRE PARENTALE R+1	179,741

TERA Environnement SAS | RCSGrenoble B n°438590390 | www.tera-environnement.com | contact@tera-environnement.com
Siège : 628 rue Charles de Gaulle, 38020 CROLLES | T 04 76 92 10 11

Agence de Fuveau : ZAC St Charles, 144 3ème rue, 13710 FUYEAU | T 04 42 60 43 20

Le seul format de rapport faisant foi est le rapport pdf.

CONFIDENTIEL : Ce document est la propriété du client et ne peut être communiqué à un tiers sans son autorisation.
La reproduction n'est autorisée que dans son intégralité.

1 sur 7



RAPPORT D'ESSAIS

Accréditation 1-5598,
portée disponible sur
cofrac.fr



Affaire N° 25AF27968

Commande N° C0002271

DNPH S10L 350MG

Numéro de lot : 18639802
Lieu de réalisation des essais : Crolles

Date d'essais : 05/02/2025

Composés	No CAS	Résultat en µg	
		DNPH-SALON RDC	DNPH-CHAMBRE
Formaldéhyde -(c)	50-00-0	3.9	3.3

Les incertitudes sont présentées en annexe de ce rapport.
Blanc analytique <LQ
Présence de DNPH résiduelle sur tous les échantillons : ok
Le blanc analytique est soustrait du résultat si >LQ

DNPH S10L 350MG

Composés	No CAS	Résultat en µg/m³	
		DNPH-SALON RDC	DNPH-CHAMBRE
Formaldéhyde -	50-00-0	21.9	18.6

Lieu de réalisation des essais : Crolles

Date d'essais : 04/02/2025

SKC 226-40-2 pour NO2

Composés	No CAS	Résultat en µg					
		1983301393-SKC		1983301395-SKC		1983301396-SKC	
		Zone mesure	Zone contrôle	Zone mesure	Zone contrôle	Zone mesure	Zone contrôle
Dioxyde d'azote (NO2)	10102-44-0	0.50	0.11	0.41	0.12	0.43	0.35

Les incertitudes sont présentées en annexe de ce rapport.

SKC 226-40-2 pour NO2

Composés	No CAS	Résultat en µg/m³					
		1983301393-SKC		1983301395-SKC		1983301396-SKC	
		Zone mesure	Zone contrôle	Zone mesure	Zone contrôle	Zone mesure	Zone contrôle
Dioxyde d'azote (NO2)	10102-44-0	14.0	3.18	11.4	3.33	12.2	9.76

TERA Environnement SAS | RCSGrenoble B n°438590390 | www.tera-environnement.com | contact@tera-environnement.com
Siège : 628 rue Charles de Gaulle, 38020 CROLLES | T 04 76 92 10 11

Agence de Fuveau : ZAC St Charles, 144 3ème rue, 13710 FUYEAU | T 04 42 60 43 20

Le seul format de rapport faisant foi est le rapport pdf.

CONFIDENTIEL : Ce document est la propriété du client et ne peut être communiqué à un tiers sans son autorisation.
Toute réimpression ou utilisation non autorisée est formellement interdite.

2 sur 7

Tubes pour COVs	Numéro de lot : -	Lieu de réalisation des essais : Crolles			Date d'essais : 05/02/2025
Masses en ng / support					
Composés	N°CAS	GAS C 20707	GAS C 20752	GAS C 20753	
Dimethyl ether	115-10-8	36.3	403	1.4	
Butane	106-97-8	92.9	273	<1.0	
Ethanol	64-17-5	40.7	1746	2.9	
Acetonitrile	75-05-8	629	1447	<1.0	
Cyclotrisiloxane, hexamethyl-	541-05-9	99.6	79.2	7.7	
Heptane, 2,2,4,6,6-pentamethyl-	13475-82-6	486	344	17.2	
Limonene	138-86-3	1763	1199	<1.0	
7-Octen-2-ol, 2,6-dimethyl-	18479-58-8	129	36.6	<1.0	
Undecane	1120-21-4	223	200	<1.0	
3-Octanol, 3,7-dimethyl-	78-89-3	91.9	24.0	<1.0	
Linalool	78-70-8	97.7	9.6	<1.0	
Cyclopentasiloxane, decamethyl-	541-02-6	95.0	76.7	<1.0	
Nonanal	124-19-6	80.0	30.9	<1.0	
Composé oxygéné de type C12H20O2 non identifié		241	199	<1.0	
Composé oxygéné de type C12H20O2 non identifié		100	46.2	<1.0	
Dodecane, 2,6,10-trimethyl-	3891-98-3	350	376	<1.0	
4-tert-Butylcyclohexyl acetate	32210-23-4	94.6	78.6	<1.0	
Composé de type siloxane non identifié	N.A.	114	73.0	<1.0	
Composé oxygéné non identifié >C12	N.A.	102	86.9	<1.0	
Composé oxygéné non identifié >C13	N.A.	95.9	101	<1.0	

Les incertitudes sont présentées en annexe de ce rapport.

Les incertitudes sont présentées en annexe de ce rapport.

Tubes pour COVs

Composés	N°CAS	Résultats en µg/m3		
		GAS C 20707	GAS C 20752	GAS C 20753
Dimethyl ether	115-10-8	2.1	22.8	0.08
Butane	106-97-8	5.3	15.4	<0.06
Ethanol	64-17-5	2.3	98.8	0.17
Acetonitrile	75-05-8	35.6	81.8	<0.06
Cyclotrisiloxane, hexaméthyl-	541-05-9	5.6	4.5	0.43
Heptane, 2,2,4,6,6-pentaméthyl-	13475-82-6	27.5	19.5	0.98
Limonene	138-86-3	99.7	67.8	<0.06
7-Octen-2-ol, 2,6-diméthyl-	18479-58-8	7.3	2.1	<0.06
Undecane	1120-21-4	12.6	11.3	<0.06
3-Octanol, 3,7-diméthyl-	78-69-3	5.2	1.4	<0.06
Linalool	78-70-8	5.5	0.54	<0.06
Cyclopentasiloxane, décaméthyl-	541-02-8	5.4	4.3	<0.06
Nonanal	124-19-6	4.5	1.7	<0.06
Composé oxygéné de type C12H20O2 non identifié		13.6	11.3	<0.06
Composé oxygéné de type C12H20O2 non identifié		5.7	2.6	<0.06
Dodecane, 2,6,10-triméthyl-	3891-98-3	19.8	21.3	<0.06
4-tert-Butylcyclohexyl acetate	32210-23-4	5.4	4.4	<0.06
Composé de type siloxane non identifié	N.A.	6.5	4.1	<0.06
Composé oxygéné non identifié >C12	N.A.	5.8	4.9	<0.06
Composé oxygéné non identifié >C13	N.A.	5.4	5.7	<0.06

Tube à TD GAS pour COVt

Numéro de lot : 20752-20707-20753

Lieu de réalisation des essais : Crolles

Date d'essais : 05/02/2025

Composés	No CAS	Résultat en ng		
		TERA 20707-GAS	TERA 20752 - GAS	TERA 20753 - GAS
COV totaux(c)	//	4 548	4 152	48.7

Les incertitudes sont présentées en annexe de ce rapport.

Tube à TD GAS pour COVt

Composés	No CAS	Résultat en µg/m³		
		TERA 20707-GAS	TERA 20752 - GAS	TERA 20753 - GAS
COV totaux	//	257	235	2.8



Tube à thermodesorption GAS Numéro de lot : 20752-20707-20753
Lieu de réalisation des essais : Crolles

Date d'essais : 05/02/2025

Composés	No CAS	Résultat en ng		
		TERA 20707-GAS	TERA 20752 - GAS	TERA 20753 - GAS
Benzène	71-43-2	17.9	11.5	11.5

Les incertitudes sont présentées en annexe de ce rapport.

Tube à thermodesorption GAS

Composés	No CAS	Résultat en µg/m³		
		TERA 20707-GAS	TERA 20752 - GAS	TERA 20753 - GAS
Benzène	71-43-2	1.0	0.65	0.65



RAPPORT D'ESSAIS

Accréditation 1-5598,
portée disponible sur
cofrac.fr



Affaire N° 25AF27968

Commande N° C0002271

Annexe

Composés	Supports	Norme	Technique analytique	Incertitude basse %	Incertitude haute %	LQ	Unité
Formaldéhyde -	DNPH S10L 350MG	NF ISO 16000-3	HPLC/UV	16	15	0,2	µg
COV totaux	Tube à TD GAS pour COVt	NF ISO16000-6	ATDGCMS C	29	25	15,0	ng
Dioxyde d'azote (NO2)	SKC 226-40-2 pour NO2	OSHA ID-182	CICD	25	25	0,1	µg
Screening 10 COVs	Tube à thermodesorption GAS	NF EN ISO 16017-1	ATDGCMS C	30	25	1,0	ng
Benzène	Tube à thermodesorption GAS	NF EN ISO 16017-1	ATDGCMS C	30	25	10,0	ng

TERA Environnement SAS | RCSGrenoble B n°438590390 | www.tera-environnement.com | contact@tera-environnement.com
Siège : 628 rue Charles de Gaulle, 38020 CROLLES | T 04 76 92 10 11

Agence de Fuveau : ZAC St Charles, 144 3ème rue, 13710 FUVEAU | T 04 42 60 43 20

Le seul format de rapport faisant foi est le rapport pdf.

CONFIDENTIEL : Ce document est la propriété du client et ne peut être communiqué à un tiers sans son autorisation.

6 sur 7

Annexe 2

Pour les screenings de COVs, les paramètres quantifiés sont nommés dans la liste ci-dessous, les autres sont quantifiés par rapport au toluène.

Composés	No CAS
IPA	67-63-0
EA	141-78-6
PGMEA	108-65-6
Anisole	100-66-3
Acetic acid butyl ester	123-86-4
Benzene	71-43-2
Toluene	108-88-3
Ethylbenzene	100-41-4
m+p Xylène	108-38-3 / 106-42-3
O Xylène	95-47-6
Naphtalène	91-20-3
Styrene	100-42-5
Hexane	110-54-3
Heptane	142-82-5
1-Octène	111-66-0
Octane	111-65-9
Nonane	111-84-2
Décane	124-18-5
Undécane	1120-21-4
Tridécan	629-50-5
Hexadécane	544-76-3
Dichlorométhane	75-09-2
1,2 dichloroethane	107-06-2
Trichloroéthylène	79-01-6
Tétrachloroéthylène	127-18-4
1,3,5 Triméthylbenzene	108-67-8
Cumène	98-82-8
P Cymène	99-87-6
Propyl benzene	103-65-1
pinène	80-56-8
Limonène	138-86-3
HMDGO	107-46-0
Méthylcyclohexane	108-87-2

Approbation

Nom(s) Fiona PELLETIER Elise EYMARD-VERNAIN

Visa(s)




FIN DU RAPPORT

TERA Environnement SAS | RCSGrenoble B n°438590390 | www.tera-environnement.com | contact@tera-environnement.com
Siège : 628 rue Charles de Gaulle, 38020 CROLLES | T 04 76 92 10 11

Agence de Fuveau : ZAC St Charles, 144 3ème rue, 13710 FUVEAU | T 04 42 60 43 20

Le seul format de rapport faisant foi est le rapport pdf.

CONFIDENTIEL : Ce document est la propriété du client et ne peut être communiqué à un tiers sans son autorisation.
La reproduction n'est autorisée que dans son intégralité.

7 sur 7