PURE AIR

For a healthier life

Rowenta

EDITORIAL

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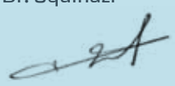
Each day, we breathe in 10,000 liters of air – that's more than 12 kilos! The quality of the air we breathe is thus an important and even vital concern to us all.

We spend about 80% of our time in enclosed spaces. Yet the air we breathe inside our homes, at work, at recreation centers and even at school is more polluted than the air outdoors. Indoor air contains many pollutants, including allergens, particles, chemical substances, microorganisms (viruses, bacteria, etc.) and possibly tobacco smoke. Some of these pollutants come from outdoors, while others are produced directly indoors – by building and finishing materials, furniture, appliances and equipment, cleaning products and room fragrances. Our own behaviors can also impair indoor air quality (poor ventilation, inadequate maintenance of mechanical ventilation, increased humidity, etc.).

Several studies have shown that continuous exposure to these pollutants has negative effects on our health in both the short and the long term. This has also been clearly recognized by health authorities.

Indoor air pollution is a major public health concern that we need to fight on a day-to-day basis. Practical and effective solutions can help each of us improve the quality of the air we breathe indoors. Air purification is not just in vogue, it's one way we can protect our health.

Dr. Squinazi



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AIR QUALITY
A global public health concern

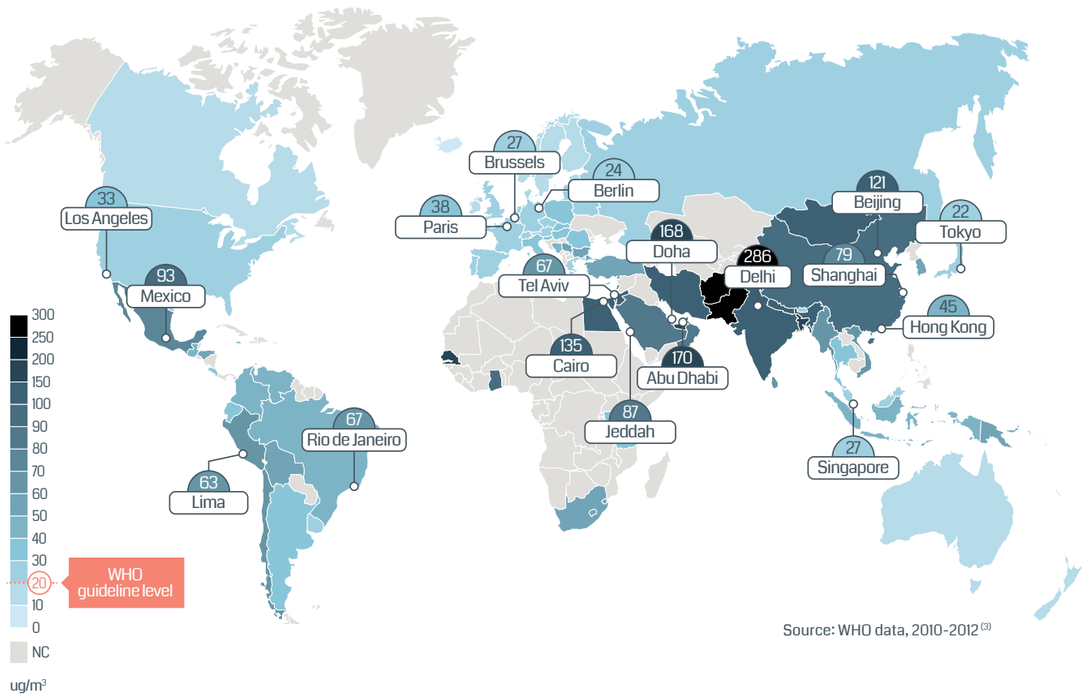
Besieged by outdoor air pollution

Air pollution is now the world's largest single environmental health risk. [1]

The principal pollutants in outside air are particles, or "*Particulate Matter*" (PM). They are classified by their size in micrometers (PM_{10}, $PM_{2.5}$, PM_{1} and $PM_{0.1}$). Fine particles ($PM_{2.5}$), are the most harmful, and were classified as known human carcinogens in 2013. [2]

Many countries have high levels of air pollution, with particle concentrations exceeding the limits set by the World Health Organization (WHO). Residents of Asian cities face the worst air pollution.

Annual mean concentrations of PM_{10} particles
$\mu g/m^3$



Source: WHO data, 2010-2012 [3]

Annual mean concentrations of $PM_{2.5}$ particles
($\mu g/m^3$) WHO guideline level: 10 ug/m^3

Tokyo	10	Los Angeles	20	Lima	38
New York	14	Hong Kong	21	Beijing	56
Paris	17	Seoul	22	Abu Dhabi	64
Singapore	17	Tel Aviv	23	Cairo	73
Brussels	18	Mexico	25	Delhi	93
Sao Paulo	19	Rio de Janeiro	36	Doha	153
Berlin	20	Shanghai	36		

Pollution outdoors, pollution indoors!

Contrary to what one might think, the air we breathe inside our homes is, on average, **2 to 8 times more polluted** than the air we breathe outdoors. [4]

According to a broad-based European study [5], indoor air contains **up to 10 times more** volatile organic compounds (VOCs) – chemical pollutants primarily generated by human activities.

Indoor air quality can be impaired by a variety of factors – from polluted outdoor air entering our homes to various sources of indoor pollution.

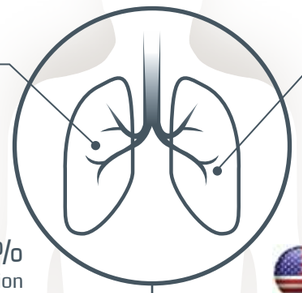
Energy efficiency and air quality DON'T NECESSARILY GO HAND IN HAND!

When we reinforce home insulation to cut energy costs, or use heating or air conditioning systems, our homes tend to be more sealed off.

When this happens, renewal of the air inside our homes is less than optimal, causing an accumulation of pollutants that are harmful to our health.

The impacts of air pollution

Poor air quality can result in physical discomfort (eye irritation, runny nose, skin redness or dryness, coughing, etc.) or even cause or worsen diseases.



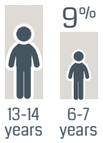
RESPIRATORY ALLERGIES

4th most important chronic disease in the world [6]

x2 Between 1980 and 2000, the prevalence of allergic diseases doubled in developed countries [6]

25-30% of the world's population has allergies [7]

15% suffer from allergic rhinitis (worldwide) [8]



ASTHMA

No.1 chronic disease among children [9]

235,000,000 people worldwide have asthma [9]

17 million people in the U.S. have asthma [10]

3 million people in Japan have asthma [11]

1 of every 6 children under the age of 16 in Australia has asthma [11]

CANCERS

17% of premature deaths caused by lung cancer are attributable to poor air quality. [12]

Poor indoor air quality may increase the frequency and severity of respiratory problems in people who have asthma or allergies. It can also increase the prevalence of these diseases.

CARDIOVASCULAR DISEASES

1,400,000 stroke deaths can be linked to poor indoor air quality. [12]

The high costs of air pollution

➡ OUTDOOR AIR

€233 billion/year
Estimated health costs of outdoor air pollution in the European Union [13]

$71-$277 billion/year
Estimated damages due to emissions of air pollution in the United States [14]

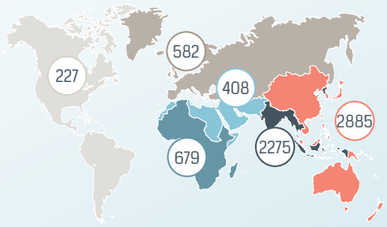
➡ INDOOR AIR

€19 billion/year
Estimated socio-economic costs of indoor air pollution in France [15]

Similar studies conducted in other countries (Italy, Netherlands and the United States) reveal similar costs, in the range of several billion euros per year. Data are nonetheless difficult to compare, as the methods used and pollutants taken into account may differ.

Air pollution killed **7 million** people in 2012

Number of deaths caused by indoor and outdoor air pollution in 2012, *by WHO region (in thousands)*



Source: WHO data, 2012 [16]

CANADA

AWARENESS/INFORMATION:

➡ **Tip sheets** for residents on improving indoor air quality at home (focus on carbon monoxide, benzene, particles, etc.).

➡ **Annual Clean Air Day.**

UNITED STATES

NATIONAL PROGRAMS:

➡ **The Air Pollution and Respiratory Health Branch**: Program to fight against environmental-related respiratory illnesses, including asthma, and studies on indoor and outdoor air pollution.

AWARENESS/INFORMATION:

➡ **Development of Indoor Air Quality Technicians**: Home improvements for patients with conditions linked to indoor environments (allergies, asthma and chronic respiratory conditions).

➡ **Tip sheets** for residents on improving indoor air quality at home (focus on carbon monoxide, benzene, particles, etc.).

FRANCE

NATIONAL PROGRAMS:

➡ **Three "Health and Environment Plans"**: Measures to monitor, improve and raise awareness about indoor air quality.

➡ **Guidelines for indoor air quality** (VGAI) have been established for 11 pollutants.

AWARENESS/INFORMATION:

➡ **Development of the role of "Indoor Environment Medical Advisors"** (CMEI): Home improvements for patients with diseases linked to indoor environments (allergies, asthma and chronic respiratory conditions).

➡ **Tip sheets** for residents on improving indoor air quality at home (focus on carbon monoxide, benzene, particles, etc.).

LABELING:

➡ Since January 2012, **labeling** of volatile pollutant emissions levels is **required** on all construction and finishing materials.

GERMANY

LABELING:

➡ Created in 1978, Germany's **"Blue Angel" ecolabel** is awarded on the basis of health and environmental criteria.

UNITED ARAB EMIRATES

NATIONAL PROGRAMS:

➡ Measures to improve indoor air quality (maintenance of air conditioning systems, low-emitting materials, etc.).

SOUTH KOREA

NATIONAL PROGRAMS:

➡ 2002-2012 **Partnership for Clean Indoor Air**: Reduction of smoke emissions linked to household cooking and heating practices.

CHINA

NATIONAL PROGRAMS:

➡ September 2013: **Five-year plan** to reduce levels of fine particles in outdoor air (record highs were reached in January 2013) – 84 measures mainly concerning the use of vehicles and carbon, the two greatest sources of pollution in China.

➡ Hong Kong, March 2013: **A Clean Air Plan for Hong Kong** involves measures to reduce pollution emissions from power plants and transportation activities.

WORLDWIDE...

➡ **WHO** guidelines levels for indoor and outdoor air quality

➡ Fine particles ($PM_{2.5}$) and formaldehyde classified as carcinogenic to humans by the International Agency for Research on Cancer **(IARC)**.

A primer on indoor AIR POLLUTION

Indoor air pollutants

The air we breathe in our homes contains a number of pollutants from varied sources.

On any given day, our homes have a certain baseline pollution level ("background level"). From time to time, this level increases sharply due to activities such as DIY projects, cooking, cleaning, decorating and furnishing our homes.

Pollutants fall into three main categories:

Pollutants in detail...

PHYSICAL POLLUTANTS

Physical pollutants include dust, particles and fibers.

Particles are generally classified by size:

- PM_{10}, or particles with a median aerodynamic diameter under 10 µm*
- $PM_{2.5}$, or particles with a median aerodynamic diameter under 2.5 µm, known as "fine particles"
- $PM_{0.1}$, or particles with a median aerodynamic diameter under 0.1 µm, known as "ultrafine particles"

Dust

Fines Particles

Fibers

Pet & Human hair

Where are they found?
In every room of the house

Where are they found?
Building materials and insulants: glass wool, mineral wool, etc.

FOCUS ON...

Fine particles:
Fine particles come from multiple sources. Some are natural (dirt particles blown by the wind), while others are linked to human activity (industry, transportation, heating, etc.). For example, diesel fine particles mainly come from vehicle traffic emissions.

Indoors, particle levels depend on various factors such as proximity to highways, cooking, heating systems, smoking, poor ventilation, etc.

Particle inhalation can increase respiratory problems and sensitivity to allergens. Particles can also aggravate respiratory diseases such as asthma or chronic obstructive pulmonary disease (COPD).

According to a European study [17], our **life expectancy at age 30 would be up to 22 months longer** if average annual levels of fine particles were reduced to 10 µg/m^3.

* µm : micrometer

CHEMICAL POLLUTANTS

Chemical pollutants contribute to background pollution levels:

Tabacco smoke

VOCs

including

Formaldehyde

Carbon monoxide

Where are they found?
They are emitted by faulty combustion equipment: heating equipment, boilers, wood-burning stoves, fireplace inserts, etc.

Where are they found?
Throughout the house: building and finishing materials, cleaning products, etc. VOCs primarily include formaldehyde, acetaldehyde, acetone, heptane, toluene and benzene.

FOCUS ON...

Formaldehyde:
Formaldehyde is a colorless, irritant gas with an acrid odor. It is highly volatile, very water soluble and also unstable. Formaldehyde is a type of volatile organic compound (VOC).

Formaldehyde is emitted by many different building and common consumer products, including tobacco smoke, scented candles, pressed wood (furniture, wood floors, etc.), cleaning and DIY products (paint, glue, varnish...), insulants, cosmetics, etc.

It irritates the eyes, nose and throat.

Formaldehyde may **increase the risk of asthma** in children and cause more frequent **sensitization to respiratory allergens**.

Since 2004, it has been classified as a known human carcinogen by the International Agency for Research on Cancer (IARC). [18]

BIOLOGICAL POLLUTANTS

Biological pollutants fall into six categories:

Pollens

Where are they found?
Ventilated living spaces located near gardens, forests or fields.

Pet allergens

Where are they found?
Cats, dogs and rodents, along with their living spaces.

Bacteria

Where are they found?
Toilets, bathrooms and bedrooms.

Viruses

Where are they found?
In every room of the house

Mold

Where are they found?
Bathrooms and other poorly ventilated rooms with high humidity.

Dust mites

Where are they found?
Bedding, sofas, rugs, carpeting and clothing.

FOCUS ON...

Pet allergens:
Pet allergens are present in the fur, skin, anal glands and saliva of pets, and they stick to clothing, sofas, rugs, carpeting, curtains, etc. They can also become airborne. In Europe, 26% of the population is sensitized to cats. [19] The main allergen produced by the domestic cat (Felis domesticus) is carried by fine particles with a diameter of less than 5 µm. It stays in suspension in the air for a very long time, even after the cat has left the area. In sensitized people, the allergen can cause very irritating **allergic reactions**, such as chronic rhinitis (runny nose and sneezing), **conjunctivitis** and **asthma**.

Dust mites:
Dust mites frequenty live in bedrooms where they can be found in mattresses, pillows, comforters, ..etc). They develop in humid surroudings (60-80%) at rather high temperature (26-32°C). They are the world's most common allergen, causing 75% of respiratory allergies. [20]

Flu virus (influenza):
Seasonal flu is a common, contagious infectious disease. There are three types of seasonal flu viruses: A, B and C. Among many subtypes of influenza A viruses, influenza **A(H1N1)** and **A(H3N2)** are currently circulating among humans. The virus generally spreads by droplets when an infected person coughs or sneezes. At the global level, flu epidemics result in about 3 to 5 million cases of severe illness, and about 250,000 to 500,000 deaths. [21]

Legionella bacteria:
Legionella bacteria tends to form in warm water (25°C-45°C). In homes, it is frequently found in hot water systems, but also in cold water systems, air conditioning systems, humidifiers, etc. The bacteria can be inhaled when sprayed through an aerosol, causing two types of respiratory illnesses. One is benign (**Pontiac fever**, 95% of cases) and usually produces flu-like symptoms. The other is serious (**Legionnaires'** disease, 5% of cases) and often results in a severe lung infection. The death rate is within the range of 5%- 10%. [22]

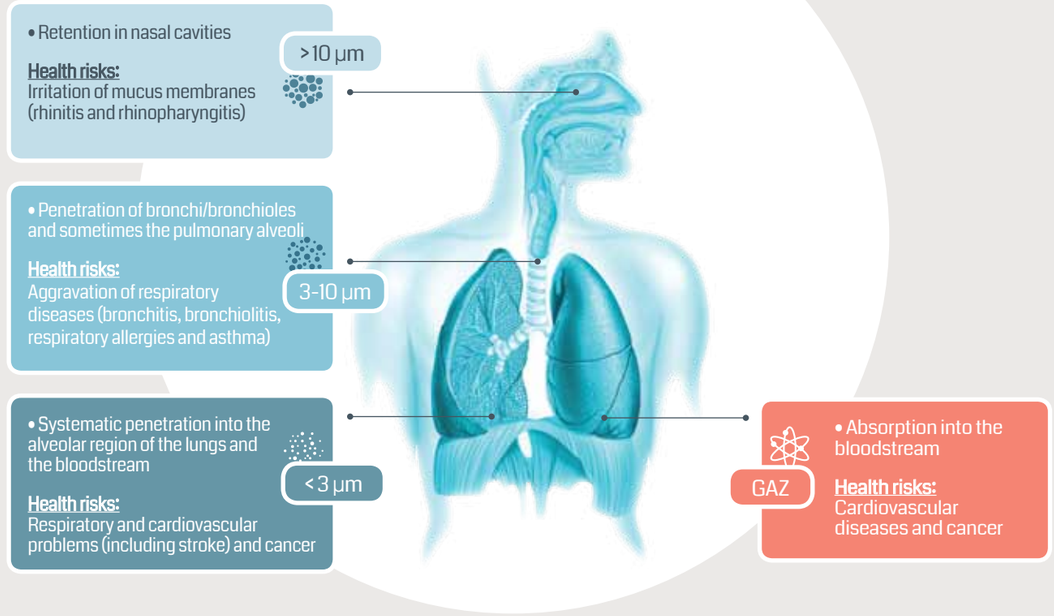
HOW DO POLLUTANTS AFFECT OUR HEALTH?

PHYSICAL AND BIOLOGICAL POLLUTANTS

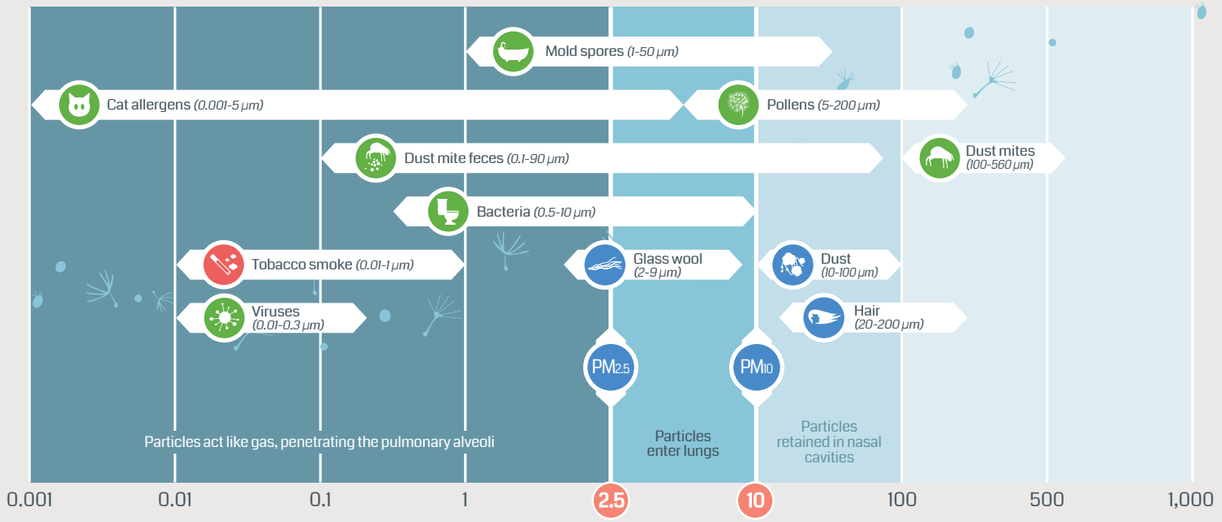
These types of pollutants can be carried by particles suspended in the air. Their impact on health depends on the size of the particles and the parts of the respiratory system they reach.

CHEMICAL POLLUTANTS

Present in the form of gas, these pollutants can be introduced via the respiratory system into the bloodstream, and thus reach the body's different organs.



Scale of some pollutants (micrometers)
1,000 µm = 1 mm



Source: [23]

SOLUTIONS
For better indoor air quality

TIPS
FOR FIGHTING INDOOR AIR POLLUTION

Taking a few simple steps can help you breathe easy every day.

Advice from Dr. Squinazi

1 MINIMIZE sources of pollution

- Choose building and finishing products with low levels of VOCs.
- Limit the use of aerosol cleaning products, which can release particles or chemical substances.
- Clean surfaces regularly with a damp cloth.
- Use a vacuum cleaner equipped with a HEPA filter.
- Wash bedding regularly, and use dust mite covers on mattresses and pillows (if you're allergic).
- Don't smoke indoors.
- Avoid houseplants that can cause allergies (such as Ficus benjamina).
- Avoid using scented candles and other room sprays.

2 AIR INDOOR spaces

- Air out rooms at least 10 minutes a day, year-round.
- Make sure they receive adequate ventilation (check that mechanical ventilation systems are in good working order).

3 USE a filter-based air purifier

By treating indoor air, these devices help combat indoor air pollution, especially for those who are most sensitive to indoor pollutants (babies, older people and people with allergies or asthma).

Filter-based air purifiers, unlike other types of purifiers (which use photocatalytic oxidation or electric fields) do not produce toxic byproducts.

4 USE a humidifier or dehumidifier

Choose a device equipped with a hygrometer to maintain optimal humidity levels.

Rowenta's commitment

We spend 80% of our time indoors, and breathe in nearly 10,000 liters of air each day. Yet, on average, indoor air is two to eight times more polluted than the air outdoors.

At Rowenta, bringing wellness and comfort to our clients has been a priority for many years. As home comfort specialists, we are proud to present our new line of Intense Pure Air air purifiers. Air treatment is essential for a healthy home, and this line rounds out our offering.

INTENSE AQUA CONTROL
Air Humidifier

INTENSE PURE AIR
Air Purifier

INTENSE DRY CONTROL
Air Deshumidifier

ROWENTA® Air Purifier range

INTENSE PURE AIR

UP TO 99.97% POLLUTION FILTERED THANKS TO 4 LEVELS OF FILTRATION

(For more details see pages 14-17)

The purifier is equipped with 4 filters adapted to each type of pollutant:
- Pre-filter
- Activated carbon Filter
- HEPA Filter
- NanoCaptur™ Filter

SMART SYSTEM

(depending on the model)

Intense Pure Air is equipped with two sensors:
- An infrared sensor that counts pollutant particles in the room
- A gas sensor (acetone, formaldehyde, benzene, etc.)

Together, these sensors measure pollution levels in your home. Depending on the level of pollution detected, the air quality indicator changes color and the filtration speed automatically adjusts to ensure optimal air quality.

Air quality indicator:

PURE AIR POLLUTION HIGH POLLUTION

2 models depending on the room size

BEDROOM MODELS

XL MODELS

	PU4020	PU6020
Recommended area	up to 35 m²	up to 80 m²
Air flow	170 m³/h	345 m³/h
CADR smoke	150 m³/h	310 m³/h
Number of filters	4	4
Speeds	4	4
Timer/Delayed Start	1 h / 2 h / 4 h / 8 h	1 h / 2 h / 4 h / 8 h
Sensors	Particles	Particles + Gas
Air quality Indicator	•	•
Automatic Modes	Auto + Night	Auto + Night
Ambient Mood Lighting	•	•
Noise Level *	22-45 dB (A)	28-52 dB (A)
Filter Change indicator	•	•
Power (W)	30 W	80 W
Dimensions (mm)	300x285x540	380x315x750
Weight (kg)	5.5 kg	7.5 kg

COMFORT IN USE

➡ NIGHT MODE

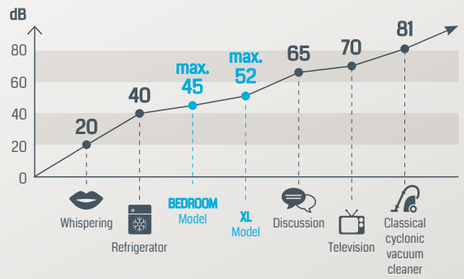
(depending on the model)

Night mode is an automatic mode which ensures air purification while remaining quiet enough to not disrupt the night's sleep.

Intense Pure Air operates in speed 1, its most silent speed, and automatically adjusts in speed 2, when pollution is detected. It is the optimal combination of a purified air and quiet nights.

➡ SILENCE

Intense Pure Air is extremely quiet:
- **BEDROOM MODELS:** from 22 to 45 dB*
- **XL MODELS:** from 28 to 52 dB*



PERFORMANCE

➡ FILTER CHANGE INDICATOR

The " HEPA " and " ODOR " indicator lights flash when the HEPA and activated carbon filters need to be changed.

These indicators reflect actual purifier usage time as well as pollution levels in the room.

➡ 3D PURE AIR FUNCTION

Intense Pure Air is equipped with an adjustable air outlet grid.

POSITION 1 (45°): Clean air is optimally and homogenously diffused throughout the room.

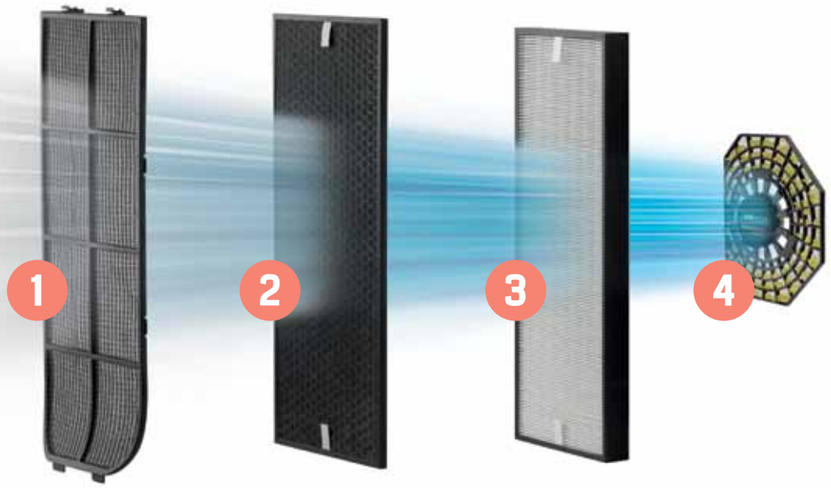
POSITION 2 (90°): Clean air is vertically diffused to ensure a high level of comfort.

* Sound pressure level measured at a distance of 1.5 meters from the air purifier in a semi-anechoic chamber.

ROWENTA® Air Purifier range

INTENSE PURE AIR
PROVEN EFFICIENCY

4 LEVELS OF FILTRATION



1

PRE-FILTER

Hair · Pet hair · Dust

The pre-filter blocks the largest particles such as dust, human and animal hair.

2

ACTIVATED CARBON FILTER

Smell · VOCs

The activated carbon filter blocks odors, gas and volatile organic compounds (VOCs).

Proven efficiency

EFFECTIVE **on VOCs** Volatile organic compounds INTENSE PURE AIR

• Method:

Intense Pure Air was placed in a climate-controlled room measuring 1.4 m³. VOCs were injected in liquid form and their concentrations were continuously monitored throughout the testing process. **Testing ended when 99% of each pollutant had been removed from the air.**

(Cf. protocol 1, page 22)

• Results:

Operating time required for the device to remove 99% of pollutants from the room *(in minutes)*

VOCs TESTED	
Acetaldehyde	73.9 min
Acetone	14.3 min
Toluene	4.4 min
Heptane	6.8 min

The time required to filter different VOCs depends on their volatility

3

HEPA FILTER

Fines Particles · Mold · Animal allergens · Pollens · Dust mites · Bacteria Viruses

The HEPA filter captures up to 99.97% of the most difficult particles to filter, i.e. those measuring 0.3 µm.

It is even more effective on smaller and larger particles.

This performance is guaranteed by the hermetically integrated HEPA filter inside the device.

Filtered pollutants include fine particles ($PM_{2.5}$), animal allergens, pollen, mold spores, flu, viruses and bacteria.

POLLUTION UP TO **99.97%** FILTERED

FOCUS ON...

The efficiency of the HEPA filter on bacteria and viruses:

The HEPA filter is effective on small size particles down to 0.01 µm. A recent INRS study[24] shows that the efficiency of the HEPA filter even increases for particles down to 0.0025 µm. Given this performance, the HEPA filter is theoretically able to stop bacteria, viruses and yeasts that are larger than 0.0025 µm. Among them are:

Bacteria *(0.5-10 µm)*	Viruses *(0.01-0.5 µm)*	Yeasts *(10-20 µm)*
Bacillus anthracis	Influenza Virus (Type A, H1N1) *(0.8-1.2 µm)*	Canidia Albicans
Escherichia coli	H3N2 *(0.8-1.2 µm)*	Monilia Albicans
Legionella pneumophila	H5N1 *(0.8-1.2 µm)*	
Staphylococcus aureus	Influenza Virus (Type A, H1N1)	

Proven efficiency

EFFECTIVE **on fine particles $PM_{2.5}$** INTENSE PURE AIR

• Method:

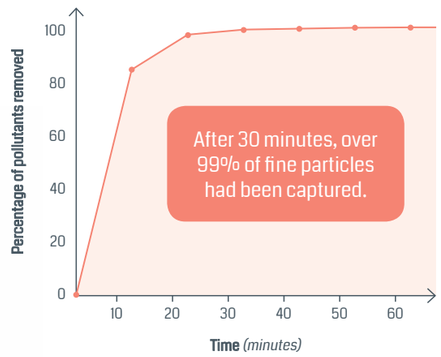
Intense Pure Air was placed in a room measuring 30 m³. Cigarette smoke was generated by a smoke extractor at a concentration of about 5 mg/m³.

The purifier was turned on and $PM_{2.5}$ concentration was measured every 10 minutes.

(Cf. protocol 2, page 22)

• Results:

Pollutants removed over time *(%)*



4

NanoCaptur Technology FILTER

With its exclusive, patented NanoCaptur™ technology, Intense Pure Air offers the most effective filtration over time* of formaldehyde, the most dangerous pollutant in our homes.

Proven efficiency

NanoCaptur Technology

5 BREVETS INTERNATIONAUX · 10 ANNÉES DE RECHERCHES · RECHERCHE FRANÇAISE · cnrs · cea

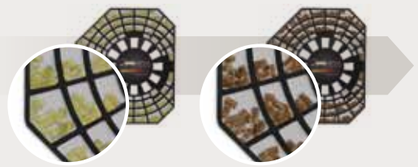
Drawing on 10 years of research** in a French research center shared by the Atomic Energy Commission (CEA) and the National Center for Scientific Research (CNRS) – NanoCaptur™ technology is protected by five international patents.***

Made up of small nanoporous granules that look like glass, **NanoCaptur™ technology permanently destroys formaldehyde.**

In contrast, traditional filtration technologies merely capture formaldehyde, releasing up to 100% of the gas once the filter is saturated.*

The NanoCaptur™ filter remains effective up to 12 times longer*, thanks to the granules microalveolar structure, which gives it a larger useful surface area.

The NanoCaptur™ filter also gradually changes color, from clear yellow to brown, making it clear and simple to check the filter's condition.



*Tested in an external laboratory vs main competitive filtration technologies, November 2014.
**CEA-CNRS licensed ETHERA technology. ***Total number of patents depending on countries.

EFFECTIVE on formaldehyde INTENSE PURE AIR

➡ 99% formaldehyde filtered

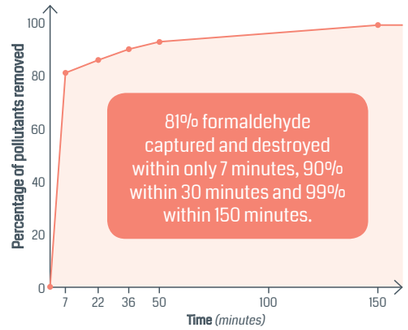
• Method:

Intense Pure Air was placed in a climate-controlled room measuring 1.4 m³. Formaldehyde was injected in liquid form and its concentration was continuously monitored throughout the testing process. **Testing ended when 99% of the formaldehyde had been removed from the air.**

(Cf. protocol 1, page 22)

• Results:

Formaldehyde removed over time (%)



➡ Formaldehyde permanently destroyed

• Method:

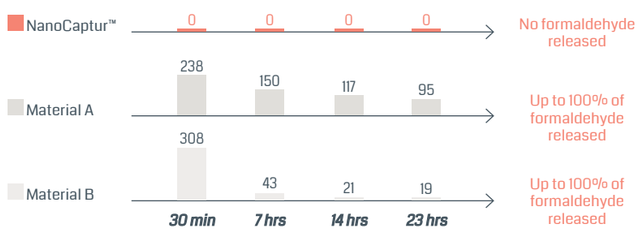
Testing was conducted to test the safety of **NanoCaptur™ filter granules** in terms their capacity to not release formaldehyde once the filter was saturated, in comparison with two of the most effective competing materials on the market (materials B and C).

Each of the three materials was first saturated with formaldehyde produced at a strong concentration. The amount of formaldehyde released by the material was then measured for 24 hours.

(Cf. protocol 3, page 22)

• Results:

Quantity of formaldehyde (ppb) released once the filter has become saturated



No formaldehyde released by the NanoCaptur™granules once the filter has become saturated. Formaldehyde is permanently destroyed.

Once the filter has become saturated, material B and C release up to 100% formaldehyde.

Clean air delivery rate

CADR

The Clean Air Delivery Rate (CADR) is the indicator commonly used to measure and compare purifier performance. It measures the volume of clean air produced and can be used to quantify the speed at which an air purifier eliminates particles in the air. The higher the CADR, the better the air purifier.

CADR is measured for three types of particles:

1 micron · 3 microns · 11 microns

• Method:

Intense Pure Air was placed in a room measuring about 12 m². The pollutants (tobacco smoke, dust and pollen) were injected into the room and their concentrations were monitored during the testing process. CADR was then calculated using the following equation:

$$CADR = V(K_e - k_n)$$

V = volume of the test chamber (cubic feet = ft³)
K_e = Total decay rate (min-1)
k_n = Natural decay rate (min-1)

These CADR values were then used to determine the ideal room size for the purifier and the number of times the device changes the air each hour.

(Cf. protocol 4, page 23)

• Results:

	Bedroom Model	XL Model
CADR smoke	150 m³/h	310 m³/h
CADR dust & pollen	160 m³/h	330 m³/h

➡ The **"Bedroom" model** is adapted for surfaces measuring up to 35 m². It allows the air to be changed around 1.5 times each hour for a room measuring this size.

➡ The **"XL" model** is adapted for surfaces measuring up to 80 m². It allows the air to be changed around 1.5 times each hour for a room measuring this size.

OPTIMAL HUMIDITY LEVELS

for more comfortable interiors

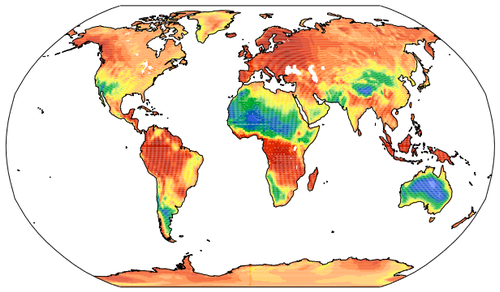
Preventing and treating air pollution in our homes is vital for good health. To control air quality, we also need to regulate indoor humidity levels, as breathing air that is too humid or too dry can harm our respiratory tracts. High humidity can also encourage the development microorganisms such as mold and dust mites.

Home humidity levels vary greatly from one country, continent or climate zone to another. According to the WHO, humidity levels are too low in 10% to 50% of indoor environments in Europe, North America, Australia, India and Japan. [25]

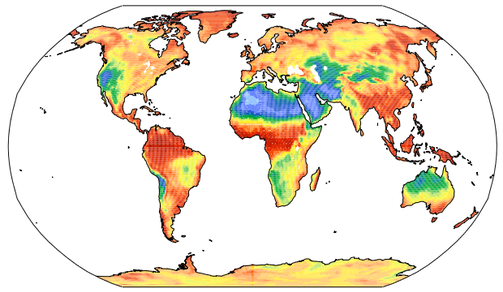
Optimal humidity levels hover around 50% to 60%. Simple solutions can help maintain these levels, ensuring greater comfort and better respiratory health.

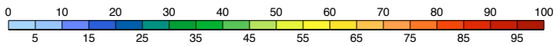
Humidity by world region
(humidity index)

January 2014



July 2014





Source: CEPMMT [26]

HEALTH IMPACTS
OF INADEQUATE HUMIDITY LEVELS

Effects on health
AIR THAT IS TOO HUMID

Air is considered too humid when relative humidity exceeds 70%.

When air is overly humid, microorganisms such as mold and dust mites can multiply, allergen particles can be suspended in air, and a variety of chemical pollutants can be released in the air.

In entering the respiratory system, these pollutants can cause chronic infections and gradual deterioration of respiratory mucosa, with consequences such as:
- lung disease, bronchitis and bronchiolitis
- chronic rhinitis and sinusitis

They can also irritate mucus membranes in the eye and cause:
- conjunctivitis
- damage to the surface of the eye

Breathing air that is too humid can also make asthma worse.

Effects on health
AIR THAT IS TOO DRY

Air is considered too dry when relative humidity falls below 30%.

When skin and moisture-rich mucus membranes are exposed to overly dry air, moisture tends to be drawn out into the air.

Breathing air that is too dry on a daily basis can thus lead to dry skin, eczema, dermatitis (skin redness) and dry eyes or conjunctivitis.

Overly dry air can also indirectly lead to chronic respiratory infections such as rhinitis, rhinopharyngitis or laryngitis.

In children, air that is too dry can irritate mucus membranes and cause respiratory difficulty, thus promoting the development of bronchiolitis.

A FEW TIPS
for controlling humidity levels at home

- Air rooms for at least 10 minutes in the morning and evening.
- Make sure that rooms exposed to high humidity are well ventilated.
- Avoid drying laundry indoors.
- Avoid houseplants that require very frequent watering.
- Keep living spaces at a comfortable temperature of 21°C and bedrooms at 19°C.

These tips may be helpful but they do not always ensure optimal humidity levels in your home.

When that is the case, air treatment devices offer an interesting solution.

Rowenta® humidifiers and dehumidifiers allow you to measure and precisely regulate a room's humidity level.

Humidifiers are for environments that are too dry and dehumidifiers are for environments that are too humid.

Product features

ROWENTA® Humidifiers

INTENSE AQUA CONTROL

Our Intense Aqua Control humidifier ensures an optimal humidity level at home, thereby reducing the risk of developing respiratory difficulties linked to overly dry air.

HYGROMETER TO MAINTAIN AN OPTIMAL HUMIDITY LEVEL

The Intense Aqua Control humidifier is equipped with a sensor that detects air humidity and automatically adjusts the mist output according to the desired level of humidity.

HEATING FUNCTION

➡ **TURBO MODE**

➡ **ANTIBACTERIAL ACTION**

The "heating" function accelerates humidity production by 20% and destroys any bacteria that may have formed in the water tank.

A study [27] conducted by the Lyon microbiology lab has shown that this function kills 100% of Escherichia coli and Staphylococcus aureus – the two most common strains of bacteria – after 30 minutes of operation under normal conditions.

3 AUTOMATIC PROGRAMS for different needs

➡ **AUTO MODE**
Humidity is maintained at 55%

➡ **BABY MODE**
Humidity is maintained at 50% to limit the risk of bronchiolitis. The device self-adjusts to ambient humidity levels and shuts off automatically after seven hours.

➡ **NIGHT MODE**
Humidity is maintained at 50%. Higher levels would increase the humidification of mucus, which is eliminated less often at night. The device adjusts to ambient humidity levels and shuts off automatically after eight hours.

In the "baby" and "night" modes, the LCD screen's backlighting shuts off and beep sounds are deactivated.

SMART DISPLAY

The humidifier is equipped with an LCD screen for clear and simple operation.

EASE OF USE

The Intense Aqua Control humidifier is equipped with a ceramic disk that vibrates at an ultrasonic frequency to produce a fine mist of water.

With a 5.5-liter tank, it can operate for up to 18 hours at a flow rate of 300 mL/hr.

Rowenta's thoughtful design includes an anti-scale cartridge that filters water before it reaches the vaporization compartment.

The humidifier can treat a surface of 45 m^2 and operates at a low noise level: 40 db(A).

Product features

ROWENTA® Deshumidifier

INTENSE DRY CONTROL

The Intense Dry Control dehumidifier maintains optimal humidity levels in your home. It reduces the risk of developing respiratory problems linked to air that is overly humid and prevents the development of mold and dust mites.

SMART DISPLAY

The dehumidifier is equipped with an LCD screen for clear and simple operation. Its built-in humidistat detects variations in humidity ranging from 20% to 100% with a range of accuracy of ±10%.

2 PROGRAMS for different needs

➡ **AUTOMATIC FUNCTION**
Automatically adjusts dehumidification speeds to reach the desired level of humidity.

➡ **MANUAL FUNCTION**
Ensures continuous dehumidification regardless of humidity levels. Two ventilation speeds: low or high.

➡ DRY LAUNDRY FUNCTION

The dehumidifier cuts drying times by half thanks to continuous dehumidification and its oscillating air grid.

SILVER ION PRE-FILTER

The pre-filter uses silver ions for a special treatment process. Silver ions have recognized antibacterial properties, and thus prevent the development of mold, fungus and bacteria.

EASE OF USE

Auto on/off timer, operating up to 24 hours.

Large capacity:
Depending on the model, the dehumidifier can collect 16, 20 or 25 liters of water per day, covering a surface area of 90 m^2.

Two modes:
- Continuous direct drain feature channels collected water to a drain system (such as a sink) using a hose.
- Water is stored in a large 5-liter tank to be emptied when full.
The condenser shuts off when the tank is full.

PROTOCOLS

Protocol 1

➡ Effectiveness of the Intense Pure Air purifier on volatile organic compounds (VOCs) and formaldehyde

TERA Environnement test reports No. 14-SE-5494-03 (VOCs) and No. 14-SE-5494-04 (formaldehyde).

- **Device and pollutants tested:**

Device tested: Intense Pure Air « XL »
- Ionizer function inactive
- Flow: 340 m^3/hr

Pollutants tested:
- Acetaldehyde (C_2H_4O, CAS 75-07-0)
- Acetone (C_3H_6O, CAS 67-64-1)
- Heptane (C_7H_{16}, CAS 142-82-5)
- Toluene (C_7H_8, CAS 108-88-3)

These four VOCs are considered to be representative of the pollutants generally found in homes.
- And formaldehyde (CH_2O, CAS 50-00-0)

- **Test methodology:**

Testing was conducted according to French standard B-44-013, in a climate-controlled room measuring 1.4 m^3 (0.9x1.3x1.2 m).
Before testing the purifier, measurements were taken to calculate the natural decay of each pollut
ant, i.e. leakage of the pollutants through the testing room. Natural decay was tested over a period of eight hours.
The purifier, which was turned off, was placed in the testing room. The pollutants were injected at t0 in liquid form. The purifier was turned on at t0 + 5 minutes and the concentrations of the different pollutants were monitored continuously throughout the testing process.
- VOC concentrations were monitored by means of an ion-molecule reaction mass spectrometer (IMR-MS).
- Formaldehyde concentrations were monitored by means of samples taken from cartridges coated with DNPH (2,4-Dinitrophenylhydrazine).

Air temperature and humidity were measured in the room throughout the testing process. CO and CO_2 concentrations are also measured during VOC testing.

Testing ended when 99% of each pollutant had been removed from the air.

- **Results:**

Pollutant concentration in the testing room was calculated using the equation of Miller and Marcher (2000):

$$C(t) = C_0 e^{-(R_V+R_N+R_{AC})xt} \qquad \ln\left(\frac{C(t)}{C_0}\right) = -kt$$

Where:
- C0: The concentration initially injected into the room
- RV: The rate of dissipation due to ventilation of the room (leakage)
- RN: The rate of dissipation due to other natural phenomena (absorption, reactivity, etc.)
- RAC: The rate of dissipation due to air purifier operation

N.B. Rates of pollutant dissipation are constant over time and the ln(C/C0)=f(t) curve is linear.

(Cf. results page 16)

Protocol 2

➡ Effectiveness of the Intense Pure Air purifier on fine particles ($PM_{2.5}$)

- **Device and pollutants tested:**

Device tested: Intense Pure Air « XL »
Ionization function inactive
Maximum speed (setting 4)

Pollutant tested: cigarette smoke

- **Test methodology:**

Testing was conducted according to Chinese standard GBT18801-2008.
Cigarette smoke was injected into a testing room measuring 30 m^2, with a temperature of 22°C and a humidity level of 42%, to attain a concentration of approximately 5 mg/m^3. A fan was used to mix the air during testing to ensure uniform smoke distribution throughout the room. The air purifier was then turned on, and $PM_{2.5}$ particles were selected by the measurement device for concentration measurements every 10 minutes.

- **Résultats :** *(Cf. curve page 15)*

Détail:

	Time *(minutes)*						
	0	10	20	30	40	50	60
Concentration *(mg/m³)*	5.63	1.01	0.17	0.021	0.001	0.001	0.001
Pollutants removed *(%)*	0	82.06%	97.05%	99.63%	99.98%	99.98%	99.98%

Protocol 3

➡ Determination of Intense Pure Air purifier safety with regard to formaldehyde

Tera Environnement test reports No.14-SE-5168 safety.

- **Materials and pollutants tested:**

Materials tested: formaldehyde (CH_2O, CAS 50-00-0)

Matériaux testés :
- Material A: NanoCaptur™ granules
- Materials B and C: two of the most effective competing materials on the market

1g of each material was used for testing.
Testing was conducted at room temperature and an average humidity level of 50%.

- **Test methodology:**

Materials were first saturated with formaldehyde produced at a concentration of approximately 500 ppbV.

Once the materials were saturated, formaldehyde production was discontinued. The materials were placed in a reactor with clean air generated at a rate of 2 L/minute for 24 hrs.

Formaldehyde concentration was calculated regularly over a period of 24 hours, upstream of each material, by means of silica gel tubes coated with DNPH (2,4-Dinitrophenylhydrazine). This concentration corresponds to the quantity of formaldehyde released by the material after saturation.

- **Results:** *(Cf. results page 17)*

Detail:

- Material A (medium A): The concentration of formaldehyde released was below the detection limit throughout the testing process (limit of quantification: 5 ppbV). These results show that NanoCaptur™ granules have the capacity to permanently destroy formaldehyde and that they do not release formaldehyde once the filter is saturated. When formaldehyde is destroyed, a chemical reaction causes the granules to turn brown.

Concentration of formaldehyde (ppbv)
released by material A over time, following saturation

Concentration *(ppbv)*	
Sampling points	**Medium A**
t0 + 15 min	< Iq
t0 + 7 h	< Iq
t0 + 14 h	< Iq
t0 + 23 h	< Iq
Limit of quantification	*5*

- Once they are saturated, materials B and C (medium B and medium C) release large amounts of formaldehyde for up to two hours:

Concentration of formaldehyde (ppbv)
released by material B and C over time, following saturation

Concentration *(ppbv)*		
Sampling points	**Medium B**	**Medium C**
t0 + 15 min	238	308
t0 + 7 h	150	43
t0 + 14 h	117	21
t0 + 23 h	95	19
Limit of quantification	*5*	*5*

Protocol 4

➡ Method for calculating Clean Air Delivery Rates (CADR)

- **Device and pollutants tested:**

Device tested: Intense Pure Air « XL » & Intense Pure Air «Bedroom »

Pollutants tested:
- Tobacco smoke: particle size from 0.10 to 1 m
- Dust: particle size from 0.5 to 3 m
- Pollen: particle size from 5 to 11 m

These three categories of particles are considered to be representative of the majority of particle sizes generally found in homes.

- **Test methodology:**

Testing was conducted according to the American standard ANSI/AHAM AC-1.

CADR was calculated separately for each category of particle and each device.

In each test, the purifier was placed in a room containing a particle counter. The room measured 11.68 m^2 (3.20x 3.65 m) and had a ceiling height of 2.44m.

Particles were then injected and a ceiling fan mixed the particles in the room. For each particle category, the following were measured:
- Natural decay (with the purifier turned off), which corresponds to the deposition of particles and ventilation in the test chamber.
- Total decay with the purifier in operation.

Measurements were taken at one-minute intervals over a period of 20 minutes for cigarette smoke and fine dust and over a period of 10 minutes for pollen.

- **Results:**

The purifier's intrinsic effectiveness for each particle category was then calculated using the following equation:

$$CADR = V(K_e - k_n)$$

where V =Volume of test chamber (cubic feet = ft^3)
K_e = Total decay rate, min-1
k_n= Natural decay rate, min-1

This equation was used to obtain «smoke CADR», «dust CADR» and «pollen CADR» values.

(Cf. results page 17)

- **Calculation of the purifier's suggested room size:**

The «smoke CADR»* was then translated into a suggested room size for the purifier, using the equation below:

$$\text{Size of the room } (ft^2) = \text{smoke CADR } (ft^3/\text{minute}) \times 1.55$$

- Calculation for the Intense Pure Air «Bedroom» model:
Smoke CADR = 150m^3/hr, or 2.5 m^3/minute, or 88.28 ft^3/minute.
The suggested room size is 88.28 ft^3/minute x 1.55 = 136.83 ft^2, or 12.71 m^2.

- Calculation for the Intense Pure Air «»XL»» model:
Smoke CADR = 150 m^3/hr, or 2.5 m^3/minute, or 88.28 ft^3/minute.
The suggested room size is 88.28 ft^3/minute x 1.55 = 136.83 ft^2, or 12.71 m^2.

- **Calculation of the number of air changes per hour:**

$$\text{Number of air changes} = \frac{\text{CADR smoke } (m^2/h)}{\text{surface } (m^2) \times h}$$

where h = ceiling height = 2.44 m

- Calculation for the Intense Pure Air «Bedroom» model:
150 m^3/hr / (12.71 m^2 x 2.44m) = 4.8 air changes, or about 5 air changes per hour for a room measuring 12m^2.
The purifier thus completes about 3 air changes (3.07) per hour for a room measuring 20 m^2, and about 1.5 air changes (1.75) per hour for a room measuring 35 m^2.

- Calculation for the Intense Pure Air «XL» model:
310 m^3/hr / (26.29 m^2 x 2.44 m) = 4.8 air changes, or about 5 air changes per hour for a room measuring 25 m^2.
The purifier thus completes about 3 air changes (3.17) per hour for a room measuring 40 m^2 and about 1.5 air changes (1.58) per hour for a room measuring 80 m^2.

*Cigarette smoke is considered as the most difficult pollutant to filter from the air.

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Source: EPA. Questions about your community: Indoor Air (update 13/09/2013) *http://www.epa.gov/region1/communities/indoorair.html* (page consulted in September 2014)
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LIST OF ACRONYMS

COPD: Chronic Obstructive Pulmonary Disease

CEA: Commissariat aux Energies Atomiques (French Atomic Energy Commission)

IARC: International Agency for Research on Cancer

CMEI: Indoor Environment Medical Advisors

CNRS: Centre National de recherche Scientifique (French National Center for Scientific Research)

VOCs : Volatile Organic Compounds

HEPA: High Efficiency Particulate Air

WORLDWIDE ACTION:
USEFUL LINKS

FRANCE

- « Plan National Santé Environnement 3 (National Health and Environment programme 3) » measures: *http://www.sante.gouv.fr/IMG/pdf/PNSE_Mesures_phares_.pdf*
- Labeling of building and finishing materials: *http://www.developpement-durable.gouv.fr/Chapitre-I-Mode-demploi-de-l.html*
- CMEI: Indoor Environment Medical Advisors: *http://www.cmei-france.fr/*
- OQAI (Observatoire de la qualité de l'air intérieur – French Observatory for Indoor air quality) pollutant fact sheets: *http://www.oqai.fr/ObsAirInt.aspx?idarchitecture=182&item=302&indice=2*

UNITED STATES

- « Air Pollution and Respiratory Health Branch » Program: *http://www.cdc.gov/nceh/airpollution/about.html*
- « Environmental Protection Agency » (EPA) polluant fact sheet: *http://www.epa.gov/air/airpollutants.html*

UNITED ARAB EMIRATES

- Abu Dhabi Environment Agency: *http://www.ead.ae/wp-content/uploads/2014/06/Enhancing-Air-Quality-in-Abu-Dhabi-2014.pdf*

CHINA

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GERMANY

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CANADA

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SOUTH KOREA

- « Partnership for clean Indoor air » program (PCIA): *http://www.pciaonline.org*

INTERNATIONAL

- WHO indoor air quality guidelines: *http://www.euro.who.int/__data/assets/pdf_file/0009/128169/e94535.pdf?ua=1*
- WHO air quality guidelines: *http://www.who.int/mediacentre/factsheets/fs313/fr/*

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