

French know-how in the field of **air pollution prevention**





| Pollutants | Sources | Properties / Impacts |
|--|---|--|
| Asbestos | A substance found in fabrics or carpets, joints, electric ovens, building materials etc | Carcinogenic Banned in France since 1997 |
| Ammonia (NH ₃) | Agriculture (breeding and farming) | Toxicity, formation of particulates in the atmosphere, eutrophication |
| Volatile Organic Compounds (VOCs): hydrocarbons (HC), solvents and organic compounds (benzene, dichloromethane, aldehydes etc) | Surface treatments, chemical industry, petrochemicals, transport, construction and fitting materials (paint, varnish, wood etc) | Certain VOCs are carcinogenic, teratogenic Impact on plant species and on the formation of tropospheric ozone |
| Sulphur dioxide (SO ₂) | Combustion appliances (heavy fuel, coal, diesel etc) | Irritates mucous membranes and airways Partly responsible for acid rain |
| Formaldehyde (Methanal) (CH ₂ O) | Incomplete combustion of substances containing carbon, degradation of materials made from urea-formaldehyde resin | Irritates the cornea and airways Carcinogenic in high doses |
| Carbon monoxide (CO) | Incomplete combustion of fuel | odourless; in high doses, can cause headaches, coma followed by death |
| Heavy metals: Arsenic, lead, mercury, nickel, copper, zinc, chrome, selenium, cadmium | Manufacturing industry (metallurgy, steelworks, chemicals, waste incineration, refineries) and transport | Toxic and neurotoxic Poisoning, serious illness |
| Molds | Caused by excess moisture in a building | Molds present allergenic and toxic risks |
| Nitrogen oxide (NO _x): nitric oxide (NO) nitrogen dioxide (NO ₂) | Road traffic, combustion reactions and high temperature processes | Irritates airways, contributes to acid rain and formation of tropospheric ozone |
| Ozone (O ₃) | Formed in the atmosphere as a result of several reactions with NO ₂ and hydrocarbons | Irritates airways and eyes |
| Particulate matter (PM): between 0.001 and 50 µm | Agriculture, combustion, industry, diesel vehicles | Can contain toxic substances (heavy metals, hydrocarbons etc) Respiratory and cardiovascular problems, carcinogenic |
| Persistent Organic Pollutants (POPs) (eg dioxins, furan, B[a]P) | Waste incineration, metallurgy, combustion, road transport, secondary products resulting from certain pesticides | Carcinogenic, effects on immune system, reproduction, development Persistent in the environment, bioaccumulative Molecules which can travel long distances |
| Radon | Of natural origin, odourless and radioactive. Comes from basements containing granite and can accumulate in poorly ventilated buildings | Damages pulmonary cells and can cause lung cancer |



Note.

This brochure presents French expertise in the field of indoor and outdoor air quality. Transport, which is at the origin of a large proportion of atmospheric pollution in France, CO₂ emissions and their impact on the climate are dealt with in other specific publications.

Photos credits

ADEME : Roland Bourguet, Gérard Crossay, Jean Paul Houdry, Joël Jaffré, Stéphane Leitenberger, Laurent Mignaux, Philippe Renault; Délégation Champagne Ardenne
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> Context

Breathing is a vital function for humans. On average, an adult inhales around 15 m³ of air per day.

Air pollution represents a major risk to health. Worldwide, it is responsible for around 2 million premature deaths every year.

Air pollution can affect the respiratory system and cause symptoms such as breathing difficulties, coughing, sore throats, headaches and eye irritation. It reduces respiratory capacity and can damage the cardiovascular system.

Industrial activity and household fireplaces used to be the principal source of atmospheric pollution in industrialised countries. This situation has changed drastically, and it is now emissions caused by the rapidly growing transport sector which are the major contributors, especially in urban areas.

The subject of air quality inside buildings is now also considered to be a matter of major concern to public health.

French people spend on average 80% of their time in enclosed spaces (housing, offices, schools etc). This situation encourages symptoms (allergies and irritations of the airways etc) in many people who have suffered long-term exposure, despite the fact that the concentration of pollutants is sometimes low.

Cutting-edge French expertise

For over 30 years, several regulatory, financial and technical tools have been developed by France, the European Union or through international conventions in order to improve the outdoor air quality.

There are currently more than 800 stations for measuring outdoor air quality across France. In 140 French towns, quality indices for 4 pollutants are calculated every day.

Almost 500,000 industrial and agricultural plants which are liable to cause pollution are also closely monitored under the ICPE regulations (Classified Installation for the Protection of the Environment). Applying these regulations to industry since the 1970's has since led to a major reduction in a large number of atmospheric pollutants in particular:

- an 85% reduction in total emissions of SO₂,
- a 39% reduction in total emissions of NO_x,
- a 40% reduction in VOCs.

Despite this progress, several pollutants still cause concern, in particular NO₂, particulate matter and ozone. Improving the knowledge and technologies to cut these emissions is still necessary.

As regards indoor air quality, several initiatives have recently been put in place in France, as a result of the Grenelle Environment Round Table, a public process which aims to prepare long-term decisions in a participatory fashion.

In particular, the Grenelle Environment Round Table aims to implement, from 2011 onwards, compulsory labelling as regards emissions from construction and decoration products. Monitoring the quality of indoor air in certain buildings open to the public is also planned.

The French air quality market is estimated at more than 4.4 billion euros (2007) with a strong potential for growth. The number of jobs directly linked to air quality is estimated to reach 15,000 by 2020.

In developing or emerging countries, there are considerable needs in terms of air quality. In several towns, concentrations of air pollutants greatly exceed the limits recommended by WHO.

Skills and know-how shown by French experts in the field of air quality, as well as excellent experience gained internationally, have meant these needs can be met.



Preserving air quality, whether indoors or outdoors, constitutes a major challenge in terms of public health and environment.

Achievements in France over the past 30 years have already resulted in significant progress in terms of outdoor

air quality, with, for example, a 75% reduction in sulphur dioxide emissions and a 30% reduction in nitrogen oxide emissions.

More recently, the "Grenelle Environnement" (Environment Round Table) has been providing impetus for public policies on the environment, regarding in particular the improvement of indoor air quality and for the development of cross sectoral approaches and air-energy-climate action plans.

Legislation adopted by the European Union and France has encouraged the development of a dynamic eco-company fabric which specialises in reducing emissions created by industry and transport, as well as ventilation, air filtering and treatment, physico-chemical analysis of pollutants or consulting. These companies are very active internationally.

This brochure presents the public and private expertise in the field of air quality. It is part of a collection that covers, in particular, renewable energy, energy efficiency in buildings, and decontamination of the soil and groundwater.

*Philippe Van de Maele,
President of the ADEME*

Several technologies are used in France to preserve air quality, from reducing pollutants at source to cleaning up atmospheric waste.

> Technologies

Outdoor air

Monitoring air quality

Monitoring air quality is an essential tool in environmental policies, at the national scale, for authorities and large industrial companies.

Monitoring makes it possible to understand and prevent air pollution or to implement action plans for permanent reduction (prevention policies) or temporary reduction. In this case, alert systems can lead to a reduction in certain polluting activities, activated when meteorological conditions are conducive to pollutant accumulation). Monitoring can also allow the efficiency of prevention policies to be evaluated.

Depending on their location, **measuring stations, which are usually automated, supply information on pollution** caused by traffic, certain industrial activities, general exposure of urban populations, and help evaluate background pollution.

Automatic measuring

Measuring can be carried out on-site, continuously or sequentially using automated appliances based on physicochemical principles. These are particularly concerned with gas analysis, such as SO_2 , NO - NO_x , CO , O_3 , VOCs, or particulate matter.

These automated appliances are used to equip most air quality monitoring networks used, especially for applying European directives.

CAIRPOL specialists in miniature sensors

CAIRPOL has designed miniature sensors to detect the tiniest amounts of air pollution caused by NO_2/O_3 , H_2S , VOCs etc. Combining a low installation cost with excellent measuring precision, these sensors are designed for individual equipment (sportsmen, asthmatics, workers, etc) as well as for industrial and office equipment.

Dedicated network software also allow to visualise measurements in real time, making it easier to exploit the pollution data.

As a research project, an initial network of 30 H_2S sensors was installed a year ago at a water treatment station (over 400,000 inhabitants), in collaboration with Veolia.

Air quality and the Beijing Olympic Games (Aria technologies/ Leosphere)

With France's help, the city of Beijing installed an integrated system to fight atmospheric pollution for the Olympic Games in 2008. This system meant that air quality in the city and the Olympic sites could be better monitored, to predict pollution levels for the following days.

The Aria Regional system used for this operation called on the following models:

- an emission model (EMMA, TREFIC) designed to manage all the inventory data and calculate road traffic emissions;
- a meteorological model (MM5) that calculates winds, temperatures and turbulence for several embedded 3D grids;
- a dispersion model (CHIMERE) that forecasts pollutant concentrations, hour by hour, over 48-hour episodes with a specific "dust" module.

In parallel, Leosphere developed Lidar, a laser radar capable of detecting and tracking aerosol layers in the atmosphere, and supplying critical meteorological information.

The combination of these two advanced technologies - ARIA Technologies and Lidar modelling - offers a tailor-made solution for Beijing and for other large cities the world.

Measuring dioxins and furans - AMESA analyser (from Environnement SA)

The AMESA system of continuous sampling enables to quantify the flux of dioxins and furans emitted by a factory throughout the year.

With over 150 AMESA systems installed worldwide, totalling over 14,000 samples, it is the world's best-selling appliance for measuring dioxins.

Passive sampling

This is carried out using absorbent cartridges exposed over lengths of time varying from a few days to a few weeks in standard conditions. It provides an average concentration for the time exposed.

It is inexpensive and can be carried out in several places to indicate the average pollution level of a site. It cannot measure peak pollution levels over short periods of time.

Active sampling techniques

Air is drawn in for analysis during standard conditions. The sample taken is stored in vacuum units. Solvents can also be absorbed on an active substrate and the dust can be filtered with or without previous granulometric selection. The analysis is then carried out in a laboratory. The value measured is an average value taken over the time of the sample.



VOC incinerator.
Reducing pollution emissions from stationary sources.

Modelling atmospheric pollution

Modelling makes it possible to understand the pollutant's behaviour in the atmosphere and how they evolve in size over time (formation, transport, accumulation, destruction and formation of new compounds such as tropospheric ozone). It is based on data supplied by measuring networks, information on the activity of main sources of pollution and meteorological data and forecasts.

It helps to predict episodes of high pollution caused for example by changes in temperature or very strong sunshine. It is also used to test emission reduction scenarios.

Fundamentally, two approaches can be implemented:

- the deterministic model, based on the description of the physical mechanisms of atmospheric dispersion,
- the statistical model, based on diagnostic or empirical equations to calculate physical parameters such as wind, turbulence etc.

Treating and reducing Volatile Organic Compounds (VOCs)

Reducing the release of COVs into the atmosphere can be carried out before or after the process. Calling on depollution techniques is required when actions at the source such as substituting products and reducing consumption are deemed insufficient to respect emission limits.

Adsorption

Adsorption is a technique based on the ability of certain solids to reversibly attach molecules. This treatment is carried out in an appliance through which the flow of gas is put into contact with the adsorbent substances.

The adsorbent substances can either be eliminated or recycled, and the organic products adsorbed can be recovered.

Absorption (scrubbing)

Absorption is a process that allows a gas phase pollutant to be transferred to a liquid phase. This gas scrubbing is carried out in a contactor and can be improved thanks to a chemical reaction that modifies the concentrations at the gas/liquid interface.

The most popular contactors are packed columns, atomiser and spray towers. One of the most effective systems is the Venturi type atomiser. Treatment by absorption sometimes requires a "pre-treatment" stage, especially for so-called "dusty" gases.

IMPACT software (ADEME)

This software calculates emissions from road vehicles during real traffic conditions for several pollutant categories.

Mapping air quality in Dubai (NUMTECH)

Specialists in the field of atmospheric modelling, NUMTECH carried out air quality mapping across the whole of Dubai, taking all sources such as transport and industry into account.

This modelling was ordered by the Dubai Municipality and was carried out in partnership with Airparif, Enviro Solutions and CTI-Chuden. An operational system for tracking and forecasting air quality across the whole of the agglomeration is currently being installed.

NO₂ mapping in Bamako with Isatis software (Geovariances)

A worldwide leader in the field of geostatistics, Geovariances offers several services for air quality surveillance (multi-variable mapping of pollutants, automatic daily mapping, evaluation of the population exposed to an atmospheric pollution threshold).

The Isatis software, at the cutting edge of geostatistics, was used to map the levels of NO₂ pollution in Bamako, Mali, thanks to a measuring campaign using passive sampling.

The project was led in partnership with Burgéap.



NO₂ mapping above the city of Bamako

Thermal and catalytic oxidation

Thermal oxidation (or incineration) converts VOCs into inorganic compounds. Depending on the elementary composition of the VOC to be destroyed, the compounds formed are either CO₂ and H₂O only, or also oxidation products from other atoms.

The temperature required for oxidising VOCs is between 600 and 1000°C. Oxidation using a catalyst means that these temperatures can be lowered to around 300 to 600°C, depending on the compounds to be destroyed.

Biological treatment

Biological treatment is implemented via an absorption process of the pollutant compounds. Absorbed VOCs are then metabolised by micro-organisms.

In an aerobic environment, the reaction results in biomass, water, mineral products, CO₂ and metabolites.

There are three types of implementation of this technique: bio-filter, bacteria bed and bio-scrubbers.

Condensation treatment

During condensation treatment, the organic compounds in the gas phase are condensed by cooling and recovered in liquid form. The recovered liquid phase is either destroyed or processed in order to recover the condensed organic compounds.

Cryogenic condensation of VOCs (Air Liquide)

A world leader in gases for industry, health and the environment, Air Liquide guides companies in analysing and monitoring effluent from production sites (stack analysis, laboratory analysis, real time monitoring of the ambient air quality and gas effluent etc)

In particular, the company has designed and installed almost a hundred cryogenic VOC condensation systems for the chemical industry. Liquid nitrogen (at -196°C/-320°F) is used as a refrigerating agent in a specific heat exchanger which the gas effluents pass through. This system allows the chemical solvents to condense, whilst the purified gas is evacuated. The solvents can then be easily recovered with a view to re-using or storing them.



Treating and reducing odours

Odorous emissions can result from organic and/or mineral pollutant waste. Reducing them requires turning to various techniques depending on the problem to be dealt with (adsorption, absorption, thermal oxidation, biological treatment). The lower the relevant olfactory detection thresholds, the higher the performance required from these processes.

Using “electronic noses” to analyse odours and VOCs (Alpha M.O.S.)

Alpha M.O.S., the world leader in producing systems to digitalise the human senses, has developed the “RQ Box”, a field solution designed for continuous monitoring of odour emissions and gaseous pollutants.

Based on the technology of the electronic nose, the RQ Box solution enables to visualise as dynamic D3 mapping the atmospheric dispersion of emissions in the vicinity of the site as well as the intensity of any resulting nuisance.

The system is also capable of alerting in real time and managing the treatment systems if the installation integrates these features.

Treating and reducing sulphur oxides (SOX)

Before combustion

The SO₂ content in waste products from combustion plants is determined by the quality of the fuel. It is therefore possible to reduce at least some of these emissions by using lower sulphur fuel.

During combustion (in the furnace)

During combustion, in systems such as fluidised beds, in which the coal is suspended in the air, injecting an alkaline product neutralises the sulphur oxides to produce sulphates which are then recovered as solids. These fluidisation techniques allow combustion to take place at lower temperatures, reducing the formation of NO_x at the same time.

After combustion (on combustion gases)

It is also possible to neutralise SO₂ in gases created during combustion.

These can be treated using three types of different processes:

- wet processes (efficiency: 95%)
- semi-dry processes (efficiency: 80-90%)
- dry processes (efficiency: 40-60%).

Treating nitrogen oxides (NO_x)

Other than emissions from agriculture and the chemical industry, the main sources of NO_x are combustion in motor vehicle engines and fixed sources, ie combustion plants.

For combustion plants, there are two types of techniques:

primary techniques (action on combustion)

Working during combustion, low-NO_x burners, the recirculation of combustion gases as well as the staged injection of fuel or combustion air reduce emissions (20 to 60% efficiency);

secondary techniques (action on the gases released):

- selective non-catalytic reduction (SNCR) at high temperature (850-1050°C) (efficiency: 50 to 70%)
- selective catalytic reduction (SCR) at 280-400°C (efficiency: up to 90%)

Reducing solid particulates emissions (dust)

There are four types of materials for limiting emissions of particulate matter released from chimneys:

- **cyclones** are used to separate the large particulates (> 15 µm) from the carrier gas by means of a mechanical force (gravitational, inertia or centrifugal force). Cyclones can guarantee emissions of about 250 to 120 mg/m³ and are often used in pre-cleaning;
- **bag filters** : particulate matters are collected when the carrier gas goes through a porous medium. They can guarantee emissions of about 10 to 5 mg/m³ and offer excellent efficiency for all types of dust, even very fine. Due to their high sensitivity at high temperatures (>250°C), using bag filters sometimes requires a system for cooling gases on entry;
- in an **electrostatic precipitator**, the particulates are ionised by negative electrodes then diverted by an electric field, so they can then be collected on earthed plates with opposing polarity. This technology offers excellent efficiency for particles and means that limits of around 30 mg/m³ to 50 mg/m³ can be respected in certain cases;
- **scrubbers** are often used when gas emissions are close to water saturation point. This technology transfers the pollutant to a liquid phase that must then be treated.

Alstom

Alstom is the world's leading supplier of air quality control systems for the electricity producing sector and for several other industrial applications. Armed with over 40 years' experience in this field, Alstom has the world's largest installed base (over 100,000 MW) in desulphurisation systems to eliminate up to 98% of sulphur dioxide released from coal-fired power plants. Recently in 2010, Alstom won a €160 million contract to design and install an air quality control system at the coal-fired power plant in Kusile, South Africa, as part of a consortium with the South African company Cosira.

Delta Neu

Delta Neu is specialized in the area of improving air quality in the industry sector with the design, manufacture and installation of ventilation systems, dust (dry or wet) and filtration of oil mist and smoke.

Modernization of Quebec plant (Bertin Technologies)

Bertin Technologies assists manufacturers and operators in the retrofitting of facilities for waste gas. The company designs, sizes and optimizes the processing systems of waste gas either at the burners, the flue gas treatment system or the reduction of VOCs and odours. For example, Bertin Technologies has completed a project management assistance for the modernization of the incineration plant for household waste of Quebec (Canada). These included defining the best technical solutions to use and perform tests to optimize furnace operation for compliance with the thresholds of carbon monoxide.

Smoke treatment project in Poland (Servithen)

Servithen installs incineration and smoke or gas emission treatment equipment, and in particular systems for treating VOCs or nitrogen oxides. For the OCP Group (Office Chérifien des Phosphates) in Morocco, the company installed a gas scrubber on two food-grade phosphate production sites and a steam scrubber on two sulphur plants.

In addition, the company installed two lines for treating smoke resulting from sludge incineration from a refinery. An adsorption process was used for treating dioxins and furans. The project was carried out for Veolia Water in Poland.

Flue gas cleaning of incineration plants Ivry (LAB)

Lab (CNIM Group), European leader for treatment of smoke, was charged in 2006 in compliance with the new European system for treating smoke plant household garbage incineration of Ivry. The facility includes in particular a wet-processing system (scrubber) to collect dust, heavy metals and acid gases and a system DeNOX/DeDiox type catalytic to treat oxides nitrogen and dioxins.



Indoor air

Whether physical, chemical or biological, there are different pollutants present in indoor air which can come from several sources:

- several pollutants can come from the outside of the building (ground and outdoor air) including radon, carbon monoxide, nitrogen oxide, particles and certain Volatile Organic Compounds (VOCs);
- combustion appliances (especially those for producing heat and hot water) can emit carbon monoxide, nitrogen oxide, particulates as well as certain VOCs;
- construction products and materials, furnishing, decoration, maintenance and DIY can emit VOCs as well as particulates;
- plants and animals can cause specific pollutants such as pollens and allergens (cats, dogs, dust mites etc);
- certain types of human activity (smoking, cooking or maintenance activities, using bathrooms, DIY etc) are also sources of humidity and several pollutants including particles, carbon monoxide, certain VOCs or molds.

Maintaining good indoor air quality in buildings is essential for protecting citizens' health.

It is especially important in certain sectors such as hospitals, pharmaceutical laboratories or electronic industries.

Technology for improving indoor air quality is either preventative (reducing pollutants at source) or curative (aeration, ventilation, filtration or aspiration techniques).

Reducing pollutants at source

In order to improve indoor air quality, it is first of all essential to control the sources of pollution:

- by the construction of the building itself: choice of site, location, orientation etc;
- through the choice of equipment as well as the materials and products used for building, decoration and furnishing, but also for maintenance and DIY;
- by adapted behaviour (limiting cigarette smoking, maintaining combustion apparatus, respecting concentrations of cleaning, hygiene and DIY products used).

Aeration and ventilation

Aeration and ventilation can reduce the concentration of carbon dioxide (limitation of containment) and certain pollutants by introducing outdoor air, evacuating polluted air and maintaining comfortable levels of humidity.

Different aeration methods and ventilation systems are present in existing buildings, depending on the type of building and relevant regulations. Indoor air can be renewed, depending on individual cases, by sealing defects, ventilation grilles and opening windows, or by natural ventilation systems or by controlled mechanical ventilation (CMV) in newer buildings.

In double-flow mechanical ventilation, an exchanger can limit heat loss which is inherent to ventilation. It recovers the heat from the air extracted and uses it to re-heat the new filtered air coming in from the outside.

There are several types of technology to regulate and control aeration and ventilation in buildings or enclosures for industrial applications.

Filtration

Filtration techniques are designed to trap particulates suspended in the air:

Mechanical filtration

Based on the use of a filter that collects the particulates, this is the most widely used air filtering technique in the world. It is used for "comfort" filtration (housing and offices) or for high and very high efficiency filtration (hospitals, sterile chambers etc).

Electrostatic filtration

The different types of electrostatic filtration make use of an electrostatic field to attract the particles onto a collecting surface.

Molecular filtration

Filtering suspended molecules is a major technological challenge. It is based on the adsorption principle using active carbon, activated alumina or resins. It can, for example, eliminate VOCs or dioxins and furans.

Dust aspiration

In certain industrial sectors, the production processes can release dust emissions within the working environment. Advanced dust aspiration technology protects the workforce and equipment from the negative impacts of pollution, and indeed the risk of explosion in certain cases, in the industrial sector.

Monitoring indoor air quality

The indoor air metrology market is currently undergoing rapid growth. Standards of quality and compliance are the same as for the equipment used for ambient air but they must be smaller and quieter.

Measuring and analysis techniques are similar to those used for outdoor air (adsorption tubes for gaseous and volatile compounds such as VOCs, filtering media for particles).

Radon, a pollutant specific to indoor air, can easily be measured inside a building: over a period of two months, a passive dosimeter records the radioactive decay of radon atoms.

Combining energy savings and indoor air quality (Veolia Environnement / Dalkia)

In the last years, Veolia Environnement has been involved in a research programme on indoor air quality (IAQ).

The solutions developed by Veolia (decentralised regulation systems for the ventilation, depending on the IAQ or the containment, systems to recover energy from the extracted air, optimising the change of filters depending on the energy consumption, real - time monitoring and reporting for IAQ...) are then tested and deployed in situ in hospitals, office buildings, swimming pools, schools or shopping centres whose energy installations are managed by Dalkia.

The energy division of Veolia Environnement, Dalkia is a european leader for energy services, managing more than 118 000 energy installations in the world.



Existing technology in France already means that air pollution problems can be measured, prevented and corrected. Private companies and public establishments join forces for major innovation and R&D projects in order to strengthen knowledge and deal with specific pollutants.

> Innovation, Research and Development

ADEME (French Environment and Energy Management Agency)

Developing tools and methods for measuring air quality, its environmental impact as well as developing technology to reduce emissions is part of ADEME's mission. ADEME's initiatives in terms of innovation and R&D are concentrated on air quality surveillance and reducing pollutant emissions.

Until 2010, ADEME has supported in particular the 3 following programs (in 2011, ADEME's priorities focus on the pollutants covered by the PNSE 2 - National Health and Environment Plan):

1. Reducing the sources of VOC emissions

The use of organic solvents in industry constitutes a major source of VOC emissions. VOC reduction can take place via treatment at the end of the process, by optimising the process (reducing solvent consumption) or by changing the products used (products with a lower VOC content).

The two latter techniques, known as reduction at source, are the best solutions since they avoid the additional treatment stage. The projects carried out therefore aim to encourage the development of new technologies for reducing VOC emissions as efficiently as possible, whilst striving for minimum cost, energy consumption and pollution transfer.

In this programme, particular attention is paid to reducing or even eliminating the use of CMR solvents (carcinogenic, mutagenic or toxic to reproduction) as well as R40 halogen compounds. Regulations demand that they must be replaced with products that are less harmful to health and the environment.

2. Intensification of French R&D in the field of emission metrology

Methods for measuring atmospheric pollutants released by fixed sources have been developed, particularly for ensuring compliance to rules imposed on plants which are subject to environmental legislation.

In terms of measuring heavy metals, French-led R&D projects have made considerable progress: CREED (Veolia's Environment, Energy and Waste Research Centre) led research on the continuous measuring of mercury released during incineration.

In partnership with the *Université de Littoral Côte d'Opale*, ArcelorMittal has developed an application for continuous measuring of lead emissions from iron ore agglomeration.

3. Olfactory pollution

ADEME supports research on identifying compounds at the origins of olfactory pollution. In particular, it aims to improve analysis methods such as "electronic noses" and to treat olfactory pollution by photocatalysis. ADEME leads operations to prevent olfactory emissions from paper and food processing industries. Adding nitrates into the tank makes it possible in particular to prevent the formation of volatile fatty acids. ADEME works on optimising "classic" treatment techniques such as biological treatment, adsorption and absorption.

Good results have been obtained on the use of photocatalysis in the food processing sector. Using UV rays, this system allows the adsorbed molecules to oxidise.

Using plasma combined with photocatalysis also allows the "odorous molecules" to break down.

MIR 9000H: heated infrared multi-gas analysers from Environnement S.A that allows selective and precise measuring of each gas in under 40 milliseconds. Designed for various uses such as detecting ammonia leaks in a DeNOx procedure (SCR and SNCR), particularly for incineration, the petrochemicals industry, gas turbines, process control, energy production etc.



Developing water-based ink (SICPA)

SICPA, the worldwide leader in supplying safety inks, has developed a range of water-based inks that no longer contain glycol ethers.

Water-based paints and non-volatile cleaning solvents (SNCF / SOFICOR MADER)

The industrial paint manufacturer SOFICOR MADER has developed a formulation of water-based paint with a very low VOC content, for SNCF (French railways).

In addition, SNCF has started using a specific solvent with no measurable VOCs for its cleaning and degreasing operations.

The MEGAPOLI European project

This FP7 project (European research program) dealt with:

- assessing aerosols sources (including organic aerosols), and the plume dispersion within a large city,
- modelling the emissions impact on air quality in Europe and beyond.



INERIS (French National Institute for the Industrial Environment and Hazards)

The INERIS works on all aspects of prevention of health and environmental risks linked to atmospheric pollution, on a local and global level: characterisation of gaseous and particulate pollutants, methodological developments in the various environments (emissions, ambient air, closed environments), creation and validation of surveillance strategies, development of air quality simulation tools and evaluation of the impact of emission reduction policies. This expertise is based on large-scale metrology and modelling research, and contributes to a better assessment of the atmospheric/health pollution interactions.

The metrology works have the objective of improving instrumental tools and devising innovative techniques and methods enabling more precise evaluation of exposure. These works relate to emerging pollutants: VOCs, pesticides, polar derivatives of Polycyclic Aromatic Hydrocarbons (PAH), ultrafine particulate matter and nano-particulates.

Thus, the institute has developed a method for real-time detection of nano-particulates by laser induced plasma spectroscopy (LIBS Technique), adapted to the monitoring of the evolution of the physicochemical composition of aerosols in the production chains of industrial processes.

Other research works are targeted on indoor pollutions and their processes of formation. Thus, since 2001 the INERIS has coordinated the RSEIN network (research on indoor health environment) which brings together all French participants in this subject.

The CSTB (French Scientific and Technical Center for Construction) is collaborating with this initiative and offers its experience acquired within the framework of the OQAI.

The modelling research programmes enable increased use of observation data (in situ, radar, airborne and satellite measurements), better understanding the process of particulate pollution formation, and the study of interactions between atmospheric pollution and climate change. Alongside partners of the PREV'AIR consortium the INERIS is involved in the construction of future services of the European GMES (Global Monitoring for Environment and Security) programme.

Over all of these subjects, the INERIS is contributing to many research programmes initiated and conducted by ANR (National Research Agency), the ADEME and the Ministries (PRIMEQUAL notably) or within the framework of R&D european programmes (FP7).

OQAI (indoor air quality research centre)

In 2009, following a national study on indoor air quality in French homes, the OQAI (indoor air quality research centre) launched a programme to understand indoor pollution in places frequented by children (nurseries, schools, colleges, swimming pools, etc.) and a second programme looking at offices.

OQAI also aims to establish indoor air quality indices, in order to evaluate the air quality in buildings (schools and homes in particular).

Initially, OQAI made an inventory of existing indices in France and abroad, in order to lead a study based on two approaches: psycho-social and psycho-environmental. The aim was to understand the needs and expectations of potential users of the indices, namely building managers (service industry, schools, housing), authorities and inhabitants. The indices should meet two types of needs: raise awareness of indoor air quality in order to change behaviour, and prevent hazards with the aim of improving housing stock.

PRIMEQUAL

The inter-company research programme for better air quality on a local scale (PRIMEQUAL) is supported and led by MEDDTL and ADEME.

It aims to bring scientific knowledge and tools to different parties within the environment, in order to help fight against air pollution.

It groups together several types of disciplines such as physical sciences (chemistry, metrology etc), life sciences (medicine, biology, ecology etc), mathematics (modelling) and social sciences (economics, sociology etc).

Examples of projects completed:

- determining contamination levels of indoor air in habitats using trihalomethanes, with a view to evaluating exposure to these substances through inhalation;
- developing biological tools to evaluate the impact of aerosols and atmospheric particles on widely polluted ecosystems.

www.primequal.fr

RNSA

The National Aerobiology Surveillance Network (RNSA) leads studies on the composition of biological particulates in the air, such as pollens or mould, which cause allergies in the population.

www.pollens.fr



A technician performs an emission control
flue chimney.

R&D on measuring fine particulates (Environnement SA)

Environnement SA, the CNRS, the National Research Agency (ANR) and the CNES have recently led a research campaign on the characterisation of light diffusion of particulates in a weightless environment.

The experiment took place on board a "Zero-G" Airbus A300 which carried out parabolic flights in order to recreate a situation of weightlessness during freefalls of around twenty seconds, so that particulates can be immobilised for advanced analysis.

These studies allowed Environnement SA to develop two new patented optical instruments:

- the CPA (Continuous Particulate Analyser) uses the light diffusion technique on a configuration of 4 angles to measure the density of the particulates (number and concentration), classify them by range and size, and provide information on the nature of the particulates (distinguish between soot, sand, ash, salt etc).
- The LOAC (Light Optical Aerosol Counter), an analyser that can be loaded onto a balloon or a drone, has a double detection facility to allow it to characterise clouds of volcanic particulates whilst providing information on the granulometry and the number of particulates



Since the 70s, France has been committed to creating the conditions necessary for improving air quality, in order to protect the health of the population as well as the environment.

> Public Policies

The Geneva Convention

In 1979, France signed the Geneva Convention of the United Nations Economic Commission for Europe on long-range atmospheric pollution. This was brought in to tackle problems caused by acid rain. Several protocols from the Convention refer to emissions of SO₂, NO_x, NMVOC, NH₃, heavy metals and persistent organic pollutants. These texts were later revised to include PM2.5.

The European Union

For more than 30 years, many European laws have been adopted and implemented, particularly in the following areas:

- setting national emission limits for the pollutants SO₂, NO_x, NMVOC and NH₃ (NEC directive). The revision of the directive provides a strengthening of the existing limits and takes into account a fifth pollutant: PM2.5;
- setting limits for Large Combustion Plants (LCPs) with a thermal input equal to or greater than 50 MW; this directive was merged with the IPPC directive in 2010, under the name of the Industrial Emissions Directive (relating to the prevention and reduction of pollution and requiring authorisation for industrial activities which are highly likely to create pollution);
- EURO ruling on limiting pollutant emissions from new vehicles;
- monitoring ambient air quality by fixing limit values and information and alert thresholds for the following pollutants: SO₂, NO₂/NO_x, CO, PM10, benzene and lead; and target values for O₃ (including information and alert thresholds), PM2.5, Benzo(a)Pyrene, Arsenic, Nickel and Cadmium.

The Grenelle Environment Round Table

The "Grenelle Environnement" is a vast consultation process. Its aim is to prepare, in a participatory fashion, long-term decisions regarding the environment and sustainable development in France.

Set up in 2007, the Grenelle Environment Round Table comprised six workgroups, including a group for "establishing an environment to respect health" which dealt with, in particular, questions regarding indoor and outdoor air quality.

These groups were made up of representatives from five boards (the State, local government, employers, employees and environmental NGOs) representing the different players in the field of sustainable development in France. After an intensive public consultation phase (19 regional meetings, 8 online forums with 11,000 contributions, 2 debates in Parliament, referrals from 31 consultative bodies), the five boards agreed on 268 specific commitments.

These commitments were then discussed in the French Parliament. Grenelle 1 Law, which sets out the main objectives and direction, was voted in almost unanimously in August 2009. Grenelle 2 Law, adopted in July 2010, defined the implementation of more concrete measures.

The Grenelle Environment Round Table and air quality

In terms of air quality, the "Grenelle Environnement" settled on these target measures:

- establishing a particulate plan to reduce by 30% concentrations of particulate matter in the air by 2015 (in line with European objectives)
- compulsory labelling of building and decoration materials, with particular regard to their volatile pollutant emissions;
- a ban on CMR1 and CMR2 substances in these products;
- a reduction in pollutants from woodburning;
- establishing measuring and information systems for indoor air quality in buildings frequented in large numbers by the public or by vulnerable people (children, the elderly etc) and in all public spaces (stations, airports, undergrounds etc).

The Grenelle II law provides the possibility of experimenting on priority air action zones, known as ZAPAs (access of which is prohibited to vehicles contributing most to atmospheric pollution) in order to strengthen the battle against atmospheric pollution and particularly to reduce emissions of nitrogen oxide and particulate matters. This experiment concerns communities or groups of communities of over 100,000 inhabitants where poor air quality has been proven.

National Health and Environment Plan (PNSE) and Regional Health and Environment Plans (PRSE)

The PNSE aims to address the concerns of the French population regarding the short- and mid-term consequences to health of exposure to certain types of pollution.

To bring the plan to fruition, all areas of French public expertise in this field were brought together within a steering group in order to:

- build a diagnosis of the health risks linked to the environment;
- identify and establish the main initiatives to be put in place between 2004 and 2008.

These initiatives constituted the first PNSE (2004-2008). The second plan (PNSE2) lays down the commitments of the "Grenelle Environnement" regarding health and the environment, and identifies and prioritises the initiatives to be taken during 2009-2013. The French regional Prefects rolled out the PNSE at a regional level and established regional health and environment plans (PRSEs) according to their regional particularities.

The PNSE2 targets the following pollutants: particulate matter (PM10 and PM2.5), PCBs, PAH, ammonia, nitrogen oxide and nitrogen dioxide, mercury, BTEX (particularly benzene, toluene), chlorinated solvents, arsenic, POPs (dioxins, PCB, PeCB), formaldehyde, nanoparticles, fluorinated gases.

Flue gas cleaning of incineration plants at Ivry by LAB (Group CNIM)





Tools for managing indoor air quality

Several initiatives are in place in France to protect citizens' health from indoor ambient air pollution, particularly within the framework of the National Health and Environment Plans and the commitments set out in the Grenelle Environment Round Table. The French Agency for Food, Environmental and Occupational Health and Safety (ANSES) also sets out limits for indoor air.

Air quality in the workplace

In order to prevent the onset of medical conditions caused by exposure to pollutants in the workplace, France has defined atmospheric concentration levels for 400 chemicals which must not be exceeded, known as occupational exposure limits (VLEP - Valeurs Limites d'Exposition Professionnelle).

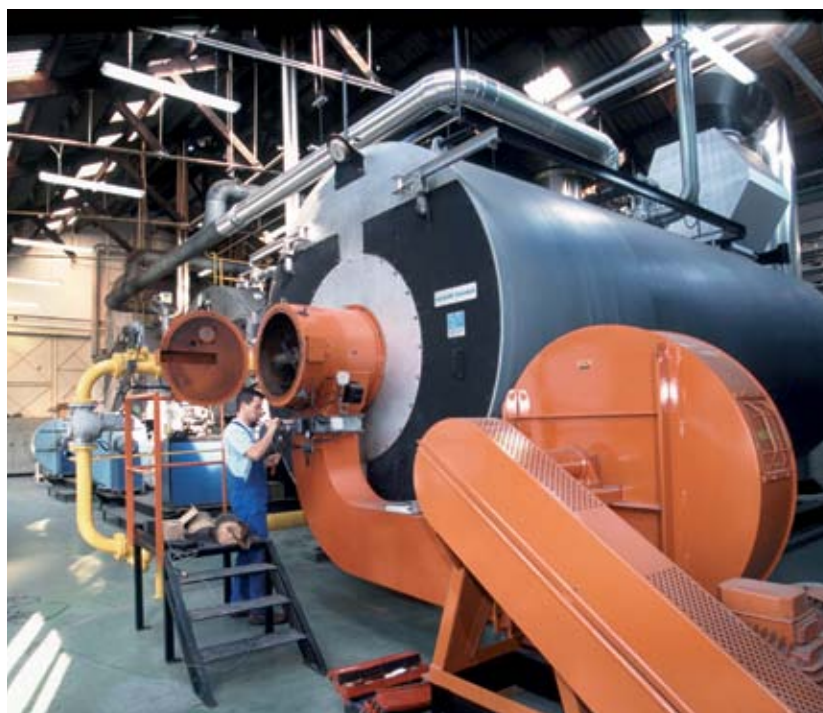
Monitoring air quality in buildings open to the public

The Grenelle 2 law provides monitoring air quality in buildings open to the public.

In order to define a method of managing indoor air in schools, the Minister in charge of sustainable development led a measuring campaign in 150 schools and nurseries during 2009/2010. A second campaign is being carried out during the 2010/2011 school year. The measuring campaigns are carried out by official associations and focus on formaldehyde, benzene and CO₂ (containment factor).

Banning of CMR substances

In 2009, France banned all substances classified as being category 1 and 2 carcinogenic, mutagenic or toxic to reproduction (CMR 1 and CMR 2) in line with European regulations, in construction and furnishing products as well as wall and floor coverings, paints and varnish, and any product which emits substances into the ambient air, or may cause them to be emitted. Two orders were published, fixing a maximum emissions threshold for construction materials in terms of four priority substances: trichlorethylene, benzene and two types of phthalates.



Maintenance of an industrial boiler "LOW NO_x" in a textile factory at Amiens. Its design is intended to cut the emissions of nitrogen oxides in the combustion process.

Labelling the principal sources of indoor air pollution

In accordance with the commitments set out in the Grenelle Environment Round Table, France has decided to gradually implement compulsory labelling, from 2011, relating to emissions from construction and decoration products (notably VOCs and formaldehyde). From 2012, compulsory labelling is envisaged relating to emissions from the most significant other indoor sources (eg furniture, maintenance products etc).

A national reference database on the environmental and health impacts of construction products (INIES) is freely available at www.inies.fr. This provides Environment and Health Declaration Sheets on construction products, supplied by the manufacturers or professional unions.

Regulatory requirements concerning building aeration

In France, several decrees and orders set the requirements for housing aeration, especially via ventilation systems.

Non-residential buildings (schools, hospitals etc) come under regional health regulations. Premises can be ventilated mechanically, or naturally using ducts. Buildings with outside walls can be ventilated by opening windows, doors or other outlets.

There have also been initiatives over more than 30 years to limit the risk of carbon monoxide poisoning in new and pre-existing buildings. In particular, a decree published in 2008 sets out the technical requirements for fitting out and ventilating residential buildings or the technical requirements that apply to combustion product evacuation systems.

In particular, monitoring exposure to radon in certain public places is compulsory. This requirement will soon be extended to residential buildings.





Tools for managing outdoor air quality

Regional climate, air quality and energy plans (SRCAE)

Run jointly by French Prefects and regional Presidents, SRCAEs establish objectives in terms of:

- attenuating and adapting to climate change and energy management
- air quality
- supplying renewable, recoverable and earth energies, in accordance with European objectives.

Law on air quality and the rational use of energy (LAURE)

The need to strengthen the surveillance and prevention of air pollution led France to pass a law on air quality and the rational use of energy (LAURE) in 1996. This lays down the fundamental right of every citizen to breathe air that is not harmful to health and to be informed about its quality and indeed its effects. The law provides for several procedures which are detailed below.

Orders and decrees

Several orders and decrees specify application details for the laws concerning:

- emissions from Classified Installations for the Protection of the Environment,
- the method for calculating air quality indices;
- methods for monitoring air quality and informing the public;
- accrediting associations that monitor air quality;
- air quality standards for pollutants, defining:
 - > the quality objective;
 - > the target;
 - > the limit;
 - > the threshold for information and recommendation;
 - > the alert threshold.
- information to be supplied to the public in the case of recommendation thresholds or alert thresholds being exceeded or at risk of being exceeded.

The system of Classified Installations

In France, 500,000 industrial or agricultural installations which are liable to create a hazard or cause pollution are subject to legislation under the ICPE regulations (Classified Installation for the Protection of the Environment). Of these installations, 61,000 are subject to a permit system, whilst the others are subject to the simple declaration system.

Industrial installations, and ICPEs in particular, must declare their atmospheric emissions every year to the public authorities, and must respect the limits on pollutant emissions into the atmosphere.

General Tax on Pollutant Activities (TGAP)

In 1985, to solve the problem of acid rain, France imposed a parafiscal tax on SO₂ emissions, later extended to other pollutants (NO_x, HCl, non-methane VOCs) which now forms part of the TGAP.

National Air Council

Created in 1997, the National Air Council is made up of 30 members from various backgrounds (administration, public establishments, MPs, qualified experts, manufacturers, associations).

It constitutes a coordination, consultation and proposals body in the field of indoor and outdoor air quality.

Regulating olfactory pollution

Olfactory pollution accounts for the second largest reason for complaint after noise pollution. A study estimated that there are tens of thousands of sites in France that are potentially responsible for odours.

Sectors concerned are mostly agriculture (livestock), food processing industries, oil refineries, the chemical industry, water treatment stations and waste processing sites. Many of the installations concerned come under the ICPE regulations.

In France, several sector-specific orders set out the objectives on olfactory pollution. These relate to:

- controlling neighbouring distances in livestock farming;
- controlling emissions at the source in the composting sector;
- controlling emissions in the slaughter-house sector.

The LCSQA (INERIS - LNE - Ecole des Mines de Douai)

Organisation appointed by France with the European Commission by way of article 3 of the directive 2008/50/CE, the Laboratoire Central de Surveillance de la Qualité de l'Air (LCSQA) is responsible for defining and creating better air quality monitoring techniques, serving as benchmark on a national level, to the AASQA, and on a European level. In this way, it is responsible for technical coordination of the national air quality monitoring system.

Official Air Quality Monitoring Associations (AASQA)

The 33 AASQA permanently evaluate the presence of 13 pollutants in the ambient air which are regulated by European directives: SO₂, NO₂, NO_x, PM10 (particulates <10 µm), lead, ozone (O₃), benzene (C₆H₆), CO, PAH, arsenic, cadmium, nickel, mercury and PM2.5 (particulates <2.5 µm).

These directives set out the thresholds which must not be exceeded, as well as information and alert thresholds.

Other specific pollutants for which no standards exist (formaldehyde, persistent organic pollutants, ammonia, odours) are also subject to research and monitoring campaigns on a case-by-case basis.

Desulfurization unit, installed in a power plant in Le Havre. Reducing emissions of pollution from stationary sources.



Alpha M.O.S. electronic nose for continuous measurement of odours





This monitoring programme is carried out by almost 400 experts, by means of:

- over 800 measuring stations, equipped with automated instruments (3,000 in total)
- 22 laboratory vans,
- frequent measuring and research campaigns,
- calculation methods for evaluating air quality and forecasting on a national and local level.

Tracking indices

In addition to the measurements taken for each pollutant, an ATMO index, as well as air quality indices, are distributed daily by accredited associations with a view to supplying summarised information on the average air quality representing the whole of the built-up area concerned (urban background pollution).

These indices are calculated over approximately 140 built-up areas (58 of which have over 100,000 inhabitants), based on the concentrations of 4 regulated pollutants in the air: NO₂, SO₂, O₃ and particulate matter (PM10).

AMERA - Measuring Atmospheric Fallout

The AMERA programme carries out continual monitoring of wet deposition and gaseous and particulate pollutants present in the atmosphere, in zones that are located far away from any source of pollution. AMERA comprises 9 measuring stations in rural areas. This programme is coordinated by ADEME and technically managed by the Ecole des Mines de Douai. The technical monitoring is guaranteed by certain AASQA. AMERA is the French contribution to the European network EMEP monitoring atmospheric pollution and long-range transboundary.

National atmospheric pollutant emissions inventory system (SNIEPA)

The SNIEPA allows France to estimate emissions of the main atmospheric pollutants for different sectors. CITEPA (The Interprofessional Technical Centre for Studies on Atmospheric Pollution) is responsible for the technical aspect of the emissions inventories.

Different inventories cover the emission of pollutants, atmospheric emissions, greenhouse gas emissions or those from large combustion plants.

Prev'Air

The PREV'AIR system is implemented under the aegis of the French ministry for Ecology and Sustainable Development, by a consortium consisting of the INERIS, Météo France, the ADEME and the CNRS.

It was set up in 2003 in order to generate and distribute, on a daily basis, in near-real time, projections and maps of air quality stemming from digital simulations and from the AASQA's observations at different spatial scales.

Ozone forecasts are available over the Globe, Europe and France; nitrogen dioxide forecasts, over Europe and France; particles are available on a European scale.

www.prevair.org

French expertise worldwide

FASEP - Green Studies & Innovation (for emerging countries)

The FASEP is an instrument for donations to local recipients (central government, provincial government, municipalities, technical agencies, etc.), of an average of around 400,000 euros. It provides funding for services that respond to requests from local recipients, which are upstream of development projects, for which funding has been identified (public or private, bilateral or multilateral), and which are likely to require the expertise of French companies (engineers, components manufacturers, operators). The budget allocated to the FASEP process is approximately €20 million per year.

The following sectors, among others, include: water, solid waste, protection of the environment (renewable energy, project mechanisms) and energy efficiency.

The following types of intervention can be supported: preparatory studies for construction projects and/or operating infrastructures; feasibility studies, preliminary pilot studies, detailed pilot studies, etc.; technical assistance in preparing or carrying out projects, institutional cooperation for economic purposes.

FASEP "Green Innovation" enables funding for pilot projects to demonstrate innovative French green technology in emerging countries.

French Development Agency (AFD) projects

With offices in over 50 countries, the AFD funds projects for economic and social development in many countries. It is the key operator of the French public aid mechanism for development. With a wide range of financial instruments (loans, grants, guarantees etc.) the AFD supports public authorities, the private sector and local community networks in the implementation of a wide variety of social and economic projects (clean public transport projects in developing countries).

AFD is also involved in the environmental sector particularly when it is involved in funding projects that can have a positive impact on air quality (clean public transport projects).

French Global Environment Facility (FGEF)

A French policy instrument for cooperation and development, the FGEF is a bilateral public fund that was created in 1994 by the French government following the Rio Summit.

FGEF cofinancing, limited to a maximum of 50% of the total project, supports multi-stakeholder partnerships, and are part of the strategic priorities of French aid.

FGEF objective is to link global environmental protection and local development through projects in the following areas: biodiversity, the fight against climate change, the management of international waters, the fight against land erosion and the treatment of persistent organic pollutants. The AFD carries out secretarial functions for the FGEF.

National air quality monitoring network in China (Burgeap)

On behalf of the Ministry of the Environment in China, Burgeap created and organised the national air quality monitoring network in China. The project benefited from FASEP financing amounting to €470,000.

The BURGEAP-IGIP Holding SE (BIHSE) group is an expert in environmental engineering and developmental assistance, with over 20,000 products in 80 countries.

Air quality forecasting system for the city of Delhi

(Aria Technologies / Leosphere)

In 2010, financed by FASEP, Leosphere and Aria Technologies rolled out an innovative air quality forecasting system for the city of Delhi. This unique tool was used successfully during the Commonwealth Games in October 2010.



To meet the needs of air quality, state-owned bodies offer a very high quality service in terms of advice and training. Hundreds of consultancies and engineering firms also offer their services in France and abroad.

> Consulting and Training

ADEME

ADEME (the French Environment and Energy Management Agency) proposes a series of books and publications (technical guides, methodologies, status reports etc) on the subject of atmospheric emissions.

ADEME's mission is to raise awareness and give support to industrial and agricultural companies and their directors, so they can gradually integrate environmental concerns into their development strategies and management techniques.

Within the framework of the Grenelle laws, the ADEME offers its support to the Ministry for the Environment to propose and support measures for prevention and reduction of atmospheric pollution and the rational use of energy with the objective of meeting air quality standards. To do this, the ADEME develops action plans for reduction of sector pollution (transport, industry, biomass, waste, etc.) and contributes to the development of territorial action plans to improve air quality (Plans for Protection of the Atmosphere, Priority Air Action Zones, etc.).

CSTB

CSTB Training (Scientific and Technical Building Centre) guides professionals in acquiring new skills and expertise by proposing training courses tailored to their needs in the building sector. The "Indoor air quality: diagnosis and recommendations" training course includes identifying the main pollutants, their sources and impacts, diagnosis methods and major recommendations for reducing health risks, regulations and standards, and finally identifying legal responsibilities when regulations are not adhered to.



Calibration of air quality measuring instruments

DREAL

DREALs (Regional Departments for the Environment, Development and Housing) are involved in the areas of development, housing and nature, preventing pollution and hazards, transport, climate and energy, in order to adhere to the sustainable development commitments set out in the Grenelle laws.

The Lorraine DREAL, for example, proposes training for classified installation inspectors on "Air dispersion: CFD modelling (Computational Fluid Dynamics)" bringing technical expertise on modelling air pollutants.

INERIS

INERIS (French National Institute for the Industrial Environment and Hazards) provides measuring, research and advisory services for companies, local authorities and administrative offices. It assists them with their safety procedures regarding the environment and health. The INERIS also offers varied training for companies and administrative offices, through its subsidiary INERIS Training, on the subjects of preventing and managing industrial and technological hazards.

Indoor air pollutants

The "Indoor air pollutants" training course offers a presentation of the different pollutants and their effects on health, the current advances in French research and the principal players in the field. Details on techniques, regulations and standards are given for the management of indoor air quality problems in buildings. A case is presented and studied in order to apply the methodology for evaluating health risks from indoor pollution.

Measuring pollutant emissions in the atmosphere

This training covers the different issues linked to measurement of pollutant emissions, such as regulatory aspects, the organisation of a measurement campaign, the technical aspect of the measurements, the whole of the French regulatory system guaranteeing quality of the measurements, the definition and evaluation of diffuse emissions, and the characterisation and impacts of emissions of odours and VOCs



> Institutions and contacts

Public institutions

Ministry of Ecology, Sustainable Development, Transport and Housing (MEDDTL)

Prepares and implements government policy in the areas of sustainable development and the environment, climate and industrial safety. Its responsibilities include, in conjunction with the Ministry of Economy, Finance and Industry, the preparation and implementation of government policy on renewable energy, the development and promotion of green technologies and the reduction of energy consumption.

www.developpement-durable.gouv.fr

Ministry of Labour, Employment, Health

Defines and implements the French public policy on health or the prevention of health risks.

www.sante-sports.gouv.fr

Ministry of Economy, Finance and Industry (MINEFI)

Responsible for French economic policy, the ministry is specifically responsible for government policy on foreign trade, industry, energy and support for businesses.

www.economie.gouv.fr

ADEME (French Agency for Environment and Energy Management)

French public institution active in the implementation of public policy in the field of the environment and energy management.

The agency stimulates, animates, coordinates, facilitates and implements operations in the following fields: waste management, soil protection, energy efficiency and renewable energies, air quality and noise reduction. ADEME provides expertise and advisory services to companies, local authorities, government bodies and the public at large.

www.ademe.fr

Club ADEME International

Network composed of some hundred French eco-companies active on the global sustainable development market, supporting its members in the development of innovative projects and partnerships internationally.

www.clubinternational.ademe.fr

The French National Agency for Food, Environmental and Occupational Health and Safety (ANSES)

ANSES is a public body responsible for food, environmental and occupational health and safety, and aims to evaluate, warn and protect citizens and consumers against risks which are becoming more and more complex and widespread.

www.anses.fr

Scientific and Technical Center for Construction (CSTB)

The CSTB carries out four key activities in the field of building innovation: research, expertise, evaluation and distribution of skills. CSTB has 850 national, European and international employees.

www.cstb.fr

French National Institute for the Industrial Environment and Hazards (INERIS)

Public institution of an Industrial and Commercial nature under the authority of the MEDDTL whose mission is to carry out or commission studies and research into preventing the risks of economic activities to health, safety of persons or property as well as the environment, and to supply all services for assisting companies in meeting this objective.

www.ineris.fr

Central Air Quality Monitoring Laboratory (LCSQA)

The general aims of the LCSQA are to support the Ministry of ecology and sustainable development on strategic, technical and scientific aspects of the air quality monitoring policy, and to contribute to ensuring the quality of measurements and information relating to air quality from the Official Air Quality Monitoring Associations (AASQA).

www.lcsqa.org

National Metrology and Testing Laboratory (LNE)

LNE is a research, calibration, testing, certification and training body. It provides expertise to all businesses involved in safety and product quality.

www.lne.fr

Indoor Air Quality Research Centre (OQAI)

The OQAI was created in 2001 on the initiative of the housing ministry. Its issue is to create a better understanding of indoor pollution, its origins and dangers, with the aim of developing recommendations in the building sector to improve indoor air quality.

www.air-interieur.org

Ubifrance and the French Trade Commissions

UBIFRANCE, the French Agency for international business development, has its own network dedicated solely to assisting SMEs in foreign markets.

The agency's 6 regional offices work (22 delegates) in partnership with Chambers of Commerce and Industry, to help mobilise businesses with export potential.

65 trade commissions in 46 countries support French businesses abroad.

www.ubifrance.fr

Private institutions

Atmospheric Pollution Prevention Association (APPA)

APPA is a scientific and technical association that has been working for over 50 years to provide better understanding and prevention of atmospheric pollution and its effects on health and the environment.

www.appa.asso.fr

Interprofessional Technical Centre for Studies in Atmospheric Pollution (CITEPA)

CITEPA groups together manufacturers, professional bodies and unions, energy producers, car manufacturers, eco-industries, consultancies and measuring laboratories, to create a real interprofessional network for circulating relevant and up-to-date information on regulatory and technological changes in the field of atmospheric pollution.

www.citepa.org

The ATMO Federation, France

The federation represents all 33 Official Air Quality Monitoring Associations (AASQA).

www.atmofrance.org

The Interprofessional Federation on Atmospheric Environment Professions (FIMEA)

FIMEA unites and structures professions and fields within the air quality market. It brings together all professions relating to the atmospheric environment with a view to promoting strong points, increase its competitiveness, encouraging its international development, creating synergies and defining common strategic direction.

<http://fimea.wordpress.com>

PEXE: France Eco-tech

This association brings together networks of French eco-companies, representing more than 3,500 eco-companies. It aims to strengthen the individual and collective competitiveness of eco-businesses and to create a network of excellence in the field of eco-activities.

www.pexe.fr

French Trade Union Federation of Aerulic, Heating, Thermodynamic and Cooling Builders (UNICLIMA)

UNICLIMA groups together equipment manufacturers (components and systems) for Aerulics and Refrigeration and focuses on: indoor air quality, respecting the atmospheric environment, comfort in domestic and professional premises, safety in industrial premises, and applications in industrial cooling.

www.uniclima.org

