

AIR QUALITY IN SCHOOLS: EVERYBODY'S DUTY, CHILDREN'S RIGHT



MINISTERO DELL'AMBIENTE
E DELLA TUTELA DEL TERRITORIO E DEL MARE



REGIONAL ENVIRONMENTAL CENTER

FOREWORD

Children are the most sensitive indicators of the relationship between environmental risk factors and the health of the general population.

The international community has for some time focused on the common objective of protecting children's health from environmental pollution and from the related risk factors that are present in air, food and water. In 1997, the Ministers for the Environment of the G8 countries approved a common declaration in Miami to consolidate and further strengthen the programmes, measures and regulations already adopted by the most developed countries to reduce the exposure of children to environmental risks. Amongst other things, The Miami Declaration indicated the need to promote the same initiatives for the protection of children of less developed and poorer countries of the world where rapid industrial and urban development is occurring, either to bring the country out of underdevelopment (China, India, Indonesia, Brazil, South Africa), or to overcome the economical and political crises that had devastated the economies of the countries of the former Soviet Union and Central Eastern Europe.

The issue of the protection of children's health at a global level was forcefully resumed at the World Summit on Sustainable Development in Johannesburg in 2002, putting an emphasis on the disparity in life expectancy and health conditions between the children of developed countries and those from less developed regions and the world's poorest countries.

This disparity also emerged from the results of the SEARCH project, carried out from 2005 to 2009 by the Regional Environmental Center in Budapest, which compared "indoor" environmental risks and the related effects on children's health in five European countries, (Albania, Bosnia and Herzegovina, Italy, Slovakia and Hungary).

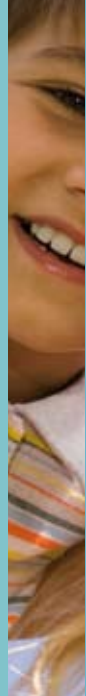
The goal of assuring the same rights to health for all the children of the world is still a long way from being reached, even in the context of a "Greater Europe".

The final declaration of the Ministers of the G8, enlarged to include Brazil, China, Egypt, India, Mexico and South Africa, from the Syracuse meeting in April 2009 once again made clear reference to this goal. The same aim is at the center of the Fifth Pan-European Conference on Environment and Health, taking place in Parma from 10 to 12 March 2010.

Participating in the Parma Conference will be the Environmental and Health Ministers of 53 European and Central Asian countries (the 27 EU states, Russia, Ukraine, Turkey, Kazakhstan, the Balkan countries, the countries of the Caucasus Region and the countries of Central Asia), the European Commission and the European Environmental Agency, leaders from the World Health Organization, the United Nations Economic Commission for Europe (UNECE), the United Nations Environment Programme (UNEP) and the Organisation for Economic Co-operation and Development (OCSE), as well as - Canada, Japan and the USA as observers.

The Parma Conference will deal with the subject of the protection of children's health and the health of new generations in the face of global and regional environmental risks in the context of a more in-depth evaluation of policies and measures, whether they deal with the prevention of risks and disease caused by environmental factors, by climate change, and socio-economical and gender inequalities, or with the promotion of programmes and common "good practices" through the co-operation between the countries of Europe and Central Asia.

Corrado Clini
Director General of the Italian Ministry
of the Environment, Land and Sea.





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FOREWORD

The IV Ministerial Environment and Health Conference of the 53 countries of the European Region of the World Health Organisation (Budapest 2004), emphasized the problem of children's health and their right to live and grow up in a healthy environment.

At the same Conference, the EU Commission launched the SCALE initiative, within the framework of the European E&H Action Plan, focused on children's environmental health.

With these goals in mind, the European Action Plan for Environmental Health and Children: the CEHAPE (*Children's Environment and Health Action Plan for Europe*) was launched in Budapest and adopted by Countries.

With CEHAPE, Member States commit themselves for concrete measures in order to implement the key objectives of the Regional Priority Goals (RPGs), including the prevention and reduction of respiratory diseases resulting from children exposure to outdoor and indoor pollutants.



In this context, the Regional Environmental Center for Central and Eastern Europe (REC) in Hungary promoted the multi-centric European **SEARCH Project** (*School Environment And Respiratory Health of Children*) involving six European countries (Hungary, Italy, Albania, Bosnia-Herzegovina, Serbia, Slovakia).



The project was mainly supported and promoted by Italy's Ministry for the Environment, Land and Sea through the Italian Trust Fund in collaboration with the REC.

The project aimed to promote the improvement of indoor air quality in schools in order to reduce the risk of acute and chronic respiratory diseases and the frequency of allergic and asthmatic attacks among sensitive children.

Selected schools were assessed collecting school information, indoor and outdoor environmental monitoring in the same seasonal period. A children's respiratory health assessment was written based on the questionnaire and spirometry tests.

Beyond assessment studies the project aimed to:

- ✓ encourage proposals of feasible measures to mitigate children's health exposure to indoor risk involving families and school staff;
- ✓ launch raising awareness initiatives about environmental risk factors in schools to all stakeholders involved in indoor air quality management, including school managers and local policy makers.

Participating countries developed their own strategies to further the project. In Italy a national coordination team was established

that included representatives from the Italian Ministry for the Environment, Land and Sea, the Superior Institute for Environmental Protection and Research (ISPRA, former APAT, acting as national EPA) and, for children's health assessment, the Maugeri Foundation. Environmental monitoring in the different regions was coordinated by ARPA Lombardy (Environmental Agency of Lombardy Region).



- Lombardy
- Lazio
- Piedmont
- Emilia Romagna
- Sardinia
- Sicily

For local monitoring, experts were appointed from environmental agencies authorities from the regions involved, that is: Lombardy itself, Emilia Romagna, Lazio, Piedmont, Sardinia and Sicily.

An Italian NGO, FEDERASMA Onlus (Italian Federation of Associations for the Treatment of Asthmatic and Allergic Illnesses), joined the ad hoc working group to facilitate the involvement of school principals, teachers and children's families.

Thanks to the proactive collaboration of all of them, it was possible to enrol around 1,000 children of the same age group in the 13 schools of 6 different regions, providing a fair representativeness of geographical differences.



The task force also managed the relationships with the project leader (REC) and the other countries participating in the multi-centric European study.

From its inception the Italy SEARCH project was viewed as an opportunity beyond assessment and figures to look more closely at local/school management issues, and institutional and resource barriers.

It was then decided to use SEARCH experience to develop this document, an informational booklet for all readers to raise awareness on the issue focusing on:

- ✓ **sharing main results from assessment together with policy considerations;**
- ✓ **an info section to inform about air quality and health, namely:**
 - indoor pollution and health risks
 - emerging risks in a changing environment
 - strategies for allergic and asthmatic children;
- ✓ **an info section on a suggested list of small, feasible actions to mitigate environmental risks for children's health.**

A technical annex is also provided with more detailed information on chemical, physical and biological risk factors and some informational elements for a healthier management of the school environment.

AIR QUALITY IN SCHOOLS: BEYOND DATA AND OBSERVATIONS

(Italian data SEARCH project)

Our living environment is changing, while our knowledge of related children's health risks is growing.

The mandate of E&H evidence-based policies urge the facilitation at local level of priority action on environmental risks that may impair children's health and their respiratory health in adulthood.

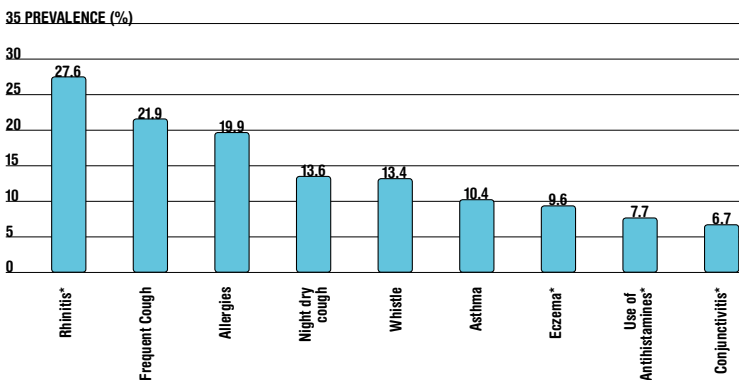
Among these actions, school indoor air quality management is most deserving of attention given the number of health determinants as well as responsible sectors (mobility and energy policies, building materials and furniture production, maintenance and management resources etc.), and that impacts on children's respiratory health are of great socio-economic consequence.



The school environment may host many environmental sources of toxics and allergens, children don't protect themselves from exposure to environmental risks, and they are more vulnerable than adults: their immune systems are still immature, they breathe faster, and the concentration of contaminants is greater in proportion to their smaller body weight. Their longer lifespan increases the risk of developing long-term (chronic) diseases with long latency periods.

The most common health effects from exposure to indoor air pollutants are respiratory and allergic diseases, which are the most common in children

There is strong evidence that adults' lung diseases have paediatric origins: in Italy, allergies represent a major group of chronic illness behind osteoporosis, arthritis and hypertension, while respiratory illnesses represent the third highest cause of death (source: ISTAT). For children, data in Italy and around the world show a growth in the prevalence of allergies and asthma. A SIDRIA study in Italy¹ showed that 20% of children under the age of 15 suffer or have in the past suffered allergic rhinitis; 9.5% of children and 10.4% of adolescents complain of asthmatic symptoms; 10% of children (6-14 years) suffer atopic dermatitis and around 8% of children under three years old and 3-4% of children of school and pre-school age suffer from food allergies. The SEARCH study confirmed this data for the roughly 1,000 enrolled students.



Students' respiratory and allergic diseases (total samples n = 939). Italian data SEARCH project.

* in the past 12 months

¹ SIDRIA II (Italian Studies on Respiratory outcomes in Children and the Environment) study in 2002 which analysed the respiratory health of around 36,000 Italian children (aged 6 to 14).

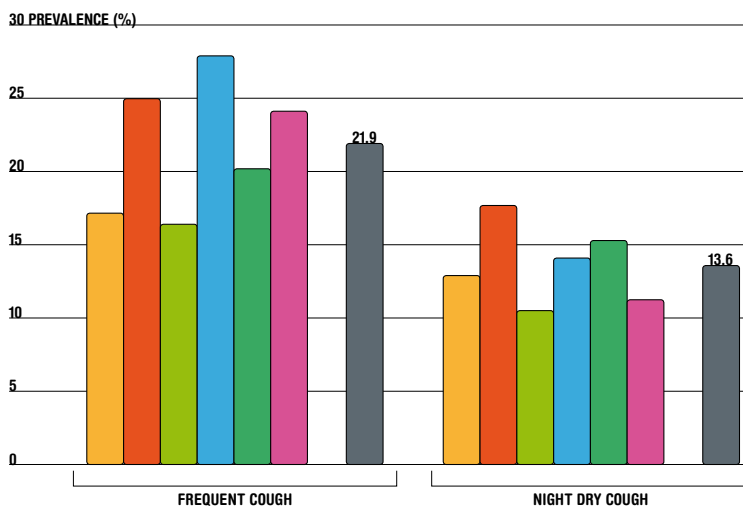
Symptoms from respiratory and allergic diseases will impair a child's right to go to school, learn and play with friends

They are the major cause of school sick days, and parents' concerns over unsafe schools can play a role in a child's isolation.

Also, medical treatments can be very costly for families. Impaired concentration and school performance can be linked to sleeping patterns and drugs side effects, and asthmatic children are often victims of bullying behaviour.



Reported symptoms.
Italian data SEARCH project.



WHY THE SCHOOL ENVIRONMENT IS SO SPECIAL

Children spent most of their time in a quite special living environment for indoor air quality management: their school and classrooms.

Children are exposed to environmental factors of a physical, biological and chemical nature in a crowded common environment

During the day different people (teachers, personnel, children) and vulnerable groups (e.g. allergic and asthmatic) spend long periods of time together squeezed into a smaller living space compared to, for example, typical office buildings.

In Italy public nurseries and schools up to 8th grade host 6,212,781 students in 307,074 classrooms with more than 50,000 teachers (ISTAT 2007-2008).

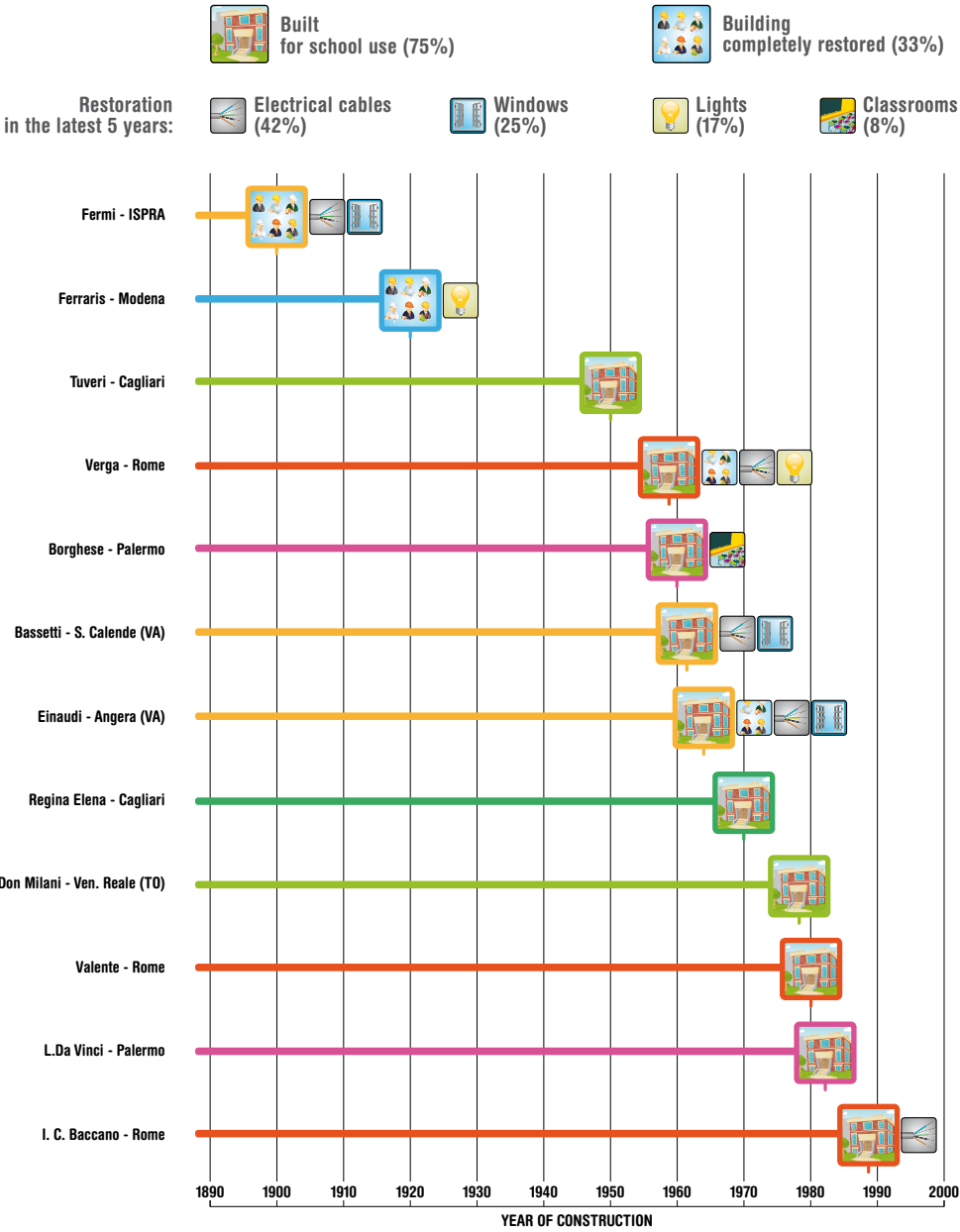
There are several potentially toxic and allergenic substances in the school environment (see annex) from indoor sources such as teaching, construction and furnishing materials, chemical detergents, as well as mould and pollens present in the areas where children play and spend their time. Inadequate management of indoor and outdoor environments at school is another risk factor along with other factors such cleaning procedures and ventilation in classrooms, gyms, toilets, libraries and teaching laboratories. Another element which should not be underestimated is the indoor-outdoor interaction, i.e. the influence of outdoor pollution on the indoor environment.

Environmental quality also depends on school site characteristics and building materials

In Italy more than 50% of school buildings were built before 1960. This was also observed in our SEARCH study.

Old schools need reconstruction and renovation, so it is important to be aware of materials which do not release chemicals and allow adequate indoor temperature and humidity. Some suggestions are described in Chapter 3. Ventilation is also an important factor and the use of CO₂ monitors may help daily management of stuffy air.

School Buildings' characteristics.
Italian data SEARCH project.

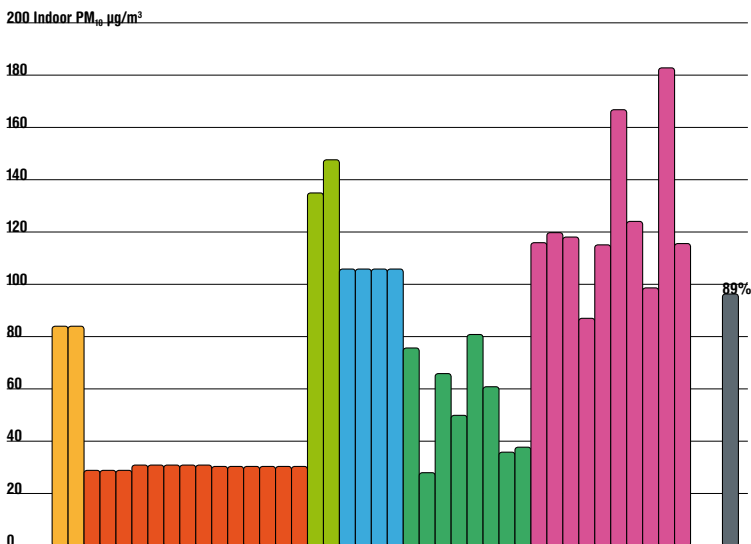


Indoor air quality also depends on substances coming from the outside and accumulating in the indoor environment

Indoor pollution is therefore affected by the quality of the air around the school. If schools are close to a high traffic area the concentrations of pollutants such as particulate matter (PM₁₀) will be higher. More than 80% of the schools investigated in the Italy SEARCH study are in urban areas and pollution outside is mainly related to traffic.

Differences in school locations explain the varying concentrations of PM₁₀ found within all classrooms investigated in Italy. This underlines the importance of the contribution of proper urban planning and mobility for indoor air quality in schools.

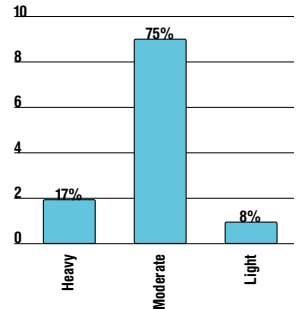
The values measured for indoor PM₁₀ are always higher than outdoors due to the external aggregation of fine particles (secondary particles) coming from outside and those generated inside (e.g. use of chalk for blackboard). (See *measures to reduce dust*, chapter 3).



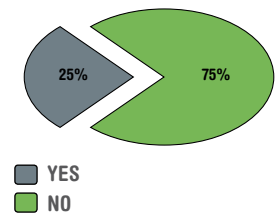
OUTDOOR POLLUTION

Traffic.

Italian data SEARCH project.



Presence of other pollution sources (e.g. factories, landfills etc.)



Indoor PM₁₀ levels.

Italian data SEARCH project.



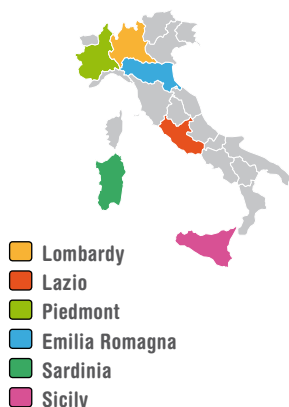
There are also indoor sources of chemical pollution

Among volatile organic compounds (VOCs), the most frequent cause of discomfort in indoor environments is formaldehyde, a colourless gas with a characteristic irritating, sharp odour. Formaldehyde is highly soluble in water, and easily causes irritation of mucous membranes of the nose, throat, airways, eyes, and skin.

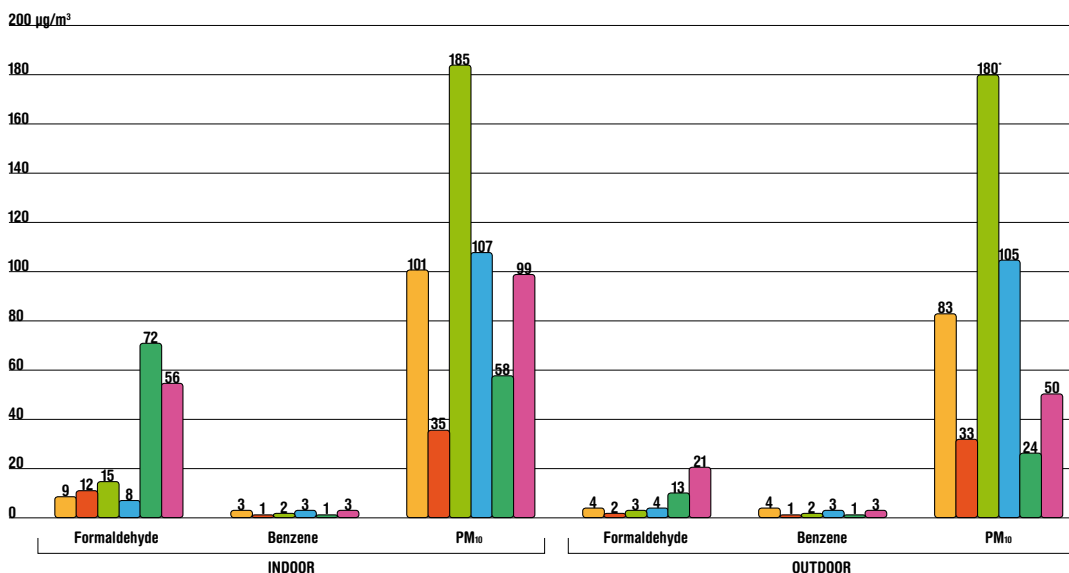
Its sources are from indoor materials. Often materials (glues, hardeners, polishing etc.) used to assemble common wood-derived modern furniture contain toxic compounds such as urea-formaldehyde, which release formaldehyde for variable periods and concentrations. Changes in temperature, humidity and ventilation can also affect levels of VOCs, for example, high levels of temperature and humidity are able to increase the emission of these substances.

These substances are nevertheless avoidable through appropriate choice of furniture and renovations materials. (*See in the annex: use of poisonous plants to abate chemicals, page 32*).

As for PM_{10} , indoor formaldehyde in our survey also shows higher values compared to outdoor.



Indoor and outdoor pollutants.
Italian data SEARCH project.



Indoor regulations are still inadequate and roles are not yet well defined

Indoor legislation, for its complexity, is also affected by the lack of regulations, even if there are many ongoing initiatives at various levels. The European Commission (DG Sanco) is finalizing its Guidelines on indoor air quality, while WHO Euro has recently provided guidelines on mould and dampness. Some countries have rules based on thresholds for safety and intervention. In Italy, following the Adopted 2001 indoor guidelines the Ministry of Health is working with regional authorities on finalizing its Guidelines for safe schools. Their implementation will, however, rely on the commitment of local authorities.

The Ministry of Environment promotes use of greener and safer materials, as well as projects on sustainable mobility for students and bio-architecture, but their implementation also largely falls on local decision-makers and school managers.

In practice, indoor pollution limit values often rely on rules regulating outdoor pollutants, workplace may have special rules.

Theoretically the school is a work environment in Italy, but several derogations for school environment are provided compared to other workplaces, including procedures for implementation of health preventive measures.

In Italy the responsibility for monitoring pollutants in indoor environments at school is still largely a pending matter in many regions. Public health departments are in charge of the safety of the school environment, and the network of paediatricians of the public National Health System has virtually replaced the old school medicine system.

INDOOR AIR QUALITY AND CHILDREN'S HEALTH: WHAT TO KNOW AND WHAT TO DO TODAY

In Europe, 71 million children and 4.5 million teachers attend schools up to 8th grade, representing 20% of the entire continent's population. In half of the European countries, children spend 8 hours per day at school (one third of the day) (EFA 2001).

Children's respiratory health can be affected by the poor quality of the school environment, which includes not only classrooms, but also dining rooms, bathrooms, gardens, building materials, furniture and outdoor pollution from the school's neighborhood.

Some children are more vulnerable than others, for example, those with allergic and asthmatic conditions, but taking care also of their needs is a gain for everybody: a healthy environment for them is indeed a healthier environment for everyone. Some environmental risk factors can be mitigated, but before doing it you need to know which one and why.



3.1 HEALTH RISKS: WHAT TO KNOW

In recent years science has paid great attention to environmental pollution and its related impacts on human health.

However, scientific research has mainly focused on the outdoor environment, and only recently has the indoor environment received its deserved attention.

In 2000, the World Health Organisation recognized “healthy breathing air in indoor environments” as a fundamental right, representing the need to plan and implement measures to reduce health effects from the indoor concentration of chemical pollutants and allergens. Special attention to children’s environmental health has been developed recently, worldwide and in Europe, especially for respiratory diseases and allergies due to their high rates of incidence.

In the past indoor environments were mainly addressed for workplaces, such as offices. The growing interest in children’s health has led to greater attention to the link between respiratory health hazards and indoor air quality in schools.

Infectious respiratory diseases

Outdoor pollutants affect schools’ indoor environmental quality and the susceptibility of children to develop respiratory disorders. The most common air pollutants have a direct irritating effect on respiratory mucous membrane, but they can also influence the frequency and length of symptoms of the more common respiratory disorders in pediatric life, facilitating recurrent acute infections of upper (e.g. rhinitis, laryngitis) and lower (bronchitis, bronchiolitis and bronchopneumonia) respiratory tracts. Some epidemiological investigations have shown that the pattern of demand for children medical treatment is influenced by outdoor air pollution.

Children's vulnerability and pollution

Children are more vulnerable to environmental risks: while they play they keep their mouths open to breathe, making ineffective their nasal filter; they breathe faster and more compared to adults, their airways are smaller, their immune system is still immature and, above all else, they are not aware of the risks resulting from exposure, and therefore they can't avoid them. In addition, their longer lifespan increases the risk of developing long-term (chronic) diseases with long latency periods.



Asthma and allergies

Over the past twenty years scientific research has shown that there is a close correlation between the various forms of allergic diseases and asthma. There is a substantial percentage of children with food allergies, whose number is growing, developing a sensitization to inhaled allergens. In addition, a large percentage of children are suffering from allergic rhinitis in childhood that will develop into asthma. Allergic rhinitis is defined by many as “the lobby of asthma” and it was also observed that asthma itself can be a symptom of food allergy.



The correlation between allergic diseases and asthma: numbers to better understand

- ✓ Approximately 80% of asthmatic patients suffer from associated allergic rhinitis.
- ✓ Approximately 40% of patients with allergic rhinitis have asthma.
- ✓ The 33-56% of patients with allergic rhinitis have symptoms of allergic conjunctivitis.
- ✓ Approximately 10% of patients with atopic dermatitis develop atopic conjunctivitis.
- ✓ Approximately 50% of children with atopic dermatitis in infancy and with both parents suffering from atopic diseases develop asthma by the age of 5.
- ✓ Over 40% of patients suffering from pollen allergies are susceptible to one or more food allergens.

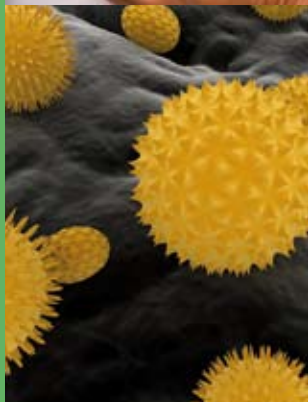
Source: Federasma

For further details on risk factors, please see also annexed CD

What is bronchial asthma?

Bronchial asthma is a chronic inflammatory illness of bronchial ways. People with asthma experience symptoms when the airways tighten, inflame, or fill with mucus. Common asthma symptoms include coughing, especially at night, wheezing, shortness of breath, chest tightness, pain, or pressure. During asthma attacks there will be a much greater effort to breathe in air and to expel it. When asthma begins in childhood, it generally happens in a child who is likely, for genetic reasons, to become sensitized to common “allergens” in the environment (atopic person). Allergic asthma crisis is triggered by many environmental factors. However, asthma is a chronic, lifelong condition and may occur at any age. Asthmatic symptoms can be extremely variable, even in the same person. Many environmental factors influence the number and the seriousness of asthma attacks. Some people with asthma may go for extended periods without having an asthma attack or other symptoms, interrupted by periodic worsening of their symptoms, due to exposure to asthma triggers. If not accurately and timely diagnosed and treated it can cause a severe impairment of the quality of everyday life. For children can be also a barrier for their involvement in sports, playing and social activities. Sometimes parents concern further limit social contact with other children. It can happen that children with asthma in school are victims of “bullying” behaviour from their peers. Environmental factors, including outdoor air pollution, will contribute to disease development and the frequency of asthma attacks. It is therefore important to identify risk factors and do the best to mitigate exposure to them.

For further details on bronchial asthma, please see also annexed CD



What are allergies?

An allergy is an abnormal reaction of the immune system against normally harmless substances in our natural environment, such as pollens, mites, mould, or metals, or introduced into the body (such as foods and/or medicines).

Such substances are generally referred to as “allergens”. The inflammatory reaction, in turn, can lead to a variety of symptoms, such as allergic rhinitis, conjunctivitis, bronchial asthma, stomach upsets, dermatitis and rashes, as well as extremely severe symptoms such as anaphylactic shock.

Dampness and poor ventilation can facilitate the presence and growth of allergens such as mould and mites. With the changing of the seasons, trees, plants and flowers release allergens capable of inducing symptoms. Dandruff and hair from domestic animals such as cats and dogs can also cause allergic reactions, as can latex, and insect bites and stings from wasps and bees, for example. Occasionally, extremely serious episodes (anaphylactic shock) may occur in highly susceptible individuals. Besides the triggering role of single factors, frequency and severity of respiratory allergies are worsened by air pollutants.

For further details on allergens, please see also annexed CD

Feeling good in the indoor environment

Stuffy air quality
is also our business

Poor air quality can be also caused by inadequate maintenance, planning or installation of ventilation systems and heating. But the presence of “stuffy” air in a confined environment also depends on our bad habits.

Indoor temperature should be around 20-22 °C with a humidity of around 40-60%. It is not advisable to go below 20% humidity because the air gets too dry, causing dryness of bronchial mucous. Regular ventilation of the premises is encouraged as is the use of a hygrometer to measure humidity.

Even in the absence of other pollutants, indoor air quality gets progressively worse the greater the presence of people in an enclosed environment for a long time. The “stuffy” air (mostly high concentrations of CO₂) can cause headaches, difficulty in concentration and drowsiness, impairing students’ and children’s performance. Everybody uses oxygen and produces carbon dioxide, water vapour (every 40 people produce 300 grams of steam per hour in relation to physical activity), heat and odours.

The frequency of indoor air recycling and replacement of the entire air volume in a room is certainly an important factor to consider, but it is difficult to quantify relationships to changes in air movement and other physical effects (e.g. Chimney effect). Simplified methods are available today - even in the form of (optic) sensory receptor alarms - using carbon dioxide as a tracer gas to indicate when it is time to “change” the air.

3.2 NEW SCENARIOS OF ENVIRONMENTAL RISK: WHAT TO KNOW

Many of us are aware of the health risks due to extreme heat or cold, thanks to growing scientific findings and awareness campaigns conducted by health authorities.

But climate variability and change may also affect the concentrations and toxicity of air pollutants, the degree of humidity and distribution of pollens and allergenic plants.

High temperatures cause an increase in tropospheric ozone, which irritates respiratory mucous membranes and acts as a cofactor in allergic reactions. Exposure to high concentrations of ozone inhibits respiratory functions and airway responsiveness to broncho constriction.

Recent studies also indicate a “triple” interaction between ozone, PM_{10} and increased temperatures that could increase the toxicity of particulate matter.

Climatic variations also include more intense rainfall and more frequent flooding with an increase of dampness inside buildings, temperature variations and dampness will facilitate the growth of mould and mites that can trigger allergic reactions. Increasing temperatures and dampness are also associated with an increase in fungal spores (*Alternaria* and *Cladosporium*). The inhalation of *Alternaria* spores is a possible cause of severe bronchoconstriction. A milder climate is causing an earlier start of spora season from late June to the beginning of the month.

CLIMATE CHANGE

Interactions between
atmospheric pollution and
increased mean temperatures

Increasing precipitation and
temperatures with consequent
increases in humidity and mould

Are you checking moulds in your
classroom after heavy raining
or dump season?

Effects on allergens and allergic responses: earlier and longer flowering season

Allergies triggered by pollens are linked to length and intensity of the pollen season, flowering frequency and to quantity of released allergens. Furthermore, meteoroclimatic variations may cause an increase in intense storms in urban areas. When they occur during pollen season, it can cause severe attacks in asthma allergic patients, since, as a result of these violent storms pollen grains are disrupted and release micro particles of only a few microns from their cytoplasm, which are strongly allergenic and can be inhaled (so called “pollen storms”).

In addition to the interaction between ozone and pollens mentioned above, pollens interact with pollutants (also heavy metals) absorbing and accumulating them on their surfaces - a “double attack” for our airways. Air pollutants interact with allergens carried by pollen grains and may amplify the risk of atopic sensitization and severe symptoms in susceptible individuals (allergic and asthmatic).

Have you checked
your garden where your
children play recently?

Climatic factors also facilitate the spread of new allergenic weeds due to greater transboundary atmospheric circulation and changes in local meteoroclimatic and environmental conditions.

For example, in abandoned green areas the introduction of new weed species has been observed, some highly allergenic. Ragweed (*Ambrosia artemisiifolia*), for example, has spread so fast as to require ad hoc legislation in the northern regions of Italy and, more recently, also in its central area.



3.3 AIR QUALITY IN SCHOOLS: WHAT TO DO

Indoor environments such as schools can contribute to exposure to pollutants. In many cases pollutant sources cannot be eliminated, unless complex, lengthy and expensive measures are taken such as moving the school into a greener area or planning a complete building renovation in accordance with ecological and healthy standards.

Pollution from traffic, noise, chemicals in furniture and building materials, the same stuffy air full of carbon dioxide, or the dust that lurks behind everywhere are all risk factors faced every day in classrooms. However, with feasible and inexpensive daily actions they can be reduced them.

Improving air quality not only improves breathing, but also:

- ✓ **Reduces absenteeism**
- ✓ **Reduces the risk of respiratory diseases, asthma and allergies**
- ✓ **Improves teachers and pupils attention**
- ✓ **Improves academic performance and productivity of students**
- ✓ **Reduces environmental factors that cause asthma and allergies**
- ✓ **Improves socialization and involvement of children with asthma and allergies**

Small actions for a healthier today and future in classrooms

Some suggestions are briefly summarized below. Some of them can be put into practice immediately and require minimal resources, while others require greater investment and planning, as in the case of building renovation.

The air in schools can be improved, for example, using plants that absorb pollutants (“poison eating” plants) or using special paints with anti-pollution and anti-bacterial effect.

WHAT TO DO NOW

✓ Against the stuffy air

- *Let in fresh air into classrooms and common environments (for 5-10 minutes several times a day);*
- *let in fresh air or provide adequate mechanical ventilation, specially in toilets, to avoid condensation and mold growth.*

✓ To fight dust

- *Use a wet cloth to clean chalk from blackboards - if possible, use a metal or plastic blackboard without toxic markers;*
- *don't pile up furniture with school supplies, books or notebooks;*
- *clean the school premises (classrooms, hallways, gym etc.) with a cloth properly rinsed and cleaned, free from dust and chemicals;*
- *pay special attention to gyms, they usually host a lot of dust;*
- *if possible, use vacuum cleaners equipped with high efficiency filters with dry steam (> 100 °C);*
- *lamine student posters and pictures to hang on the walls, so you can wash them to take off dust;*
- *wood or plastic atoxic games are easy to clean, avoid soft furry toys;*
- *avoid carpets; alternatively use easy to wash ones.*

✓ To fight chemicals

- *Consider the possibility of using indoor plants to reduce the presence of chemical pollutants indoor (see annex);*
- *keep in mind the potential risks for allergies when planning mosquito spraying. The installation of mosquito nets can be healthier, more effective and long lasting;*
- *clean the school after school hours and never while children are still inside;*
- *make sure not to use toxic detergents for cleaning and ventilate afterwards.*

✓ Pollen

- *Eliminate highly allergenic plants in open spaces where children play;*
- *avoid gardening (grass cutting etc.) during school hours.*



✓ How to avoid animal and food allergens in classrooms

- *Hang coats outside the classroom;*
- *after snacks, clean with a damp cloth to remove food leftovers;*
- *make sure kids wash hands and mouth thoroughly;*
- *if the children are sleeping at school, avoid letting them eat in their beds (baby bottles, cookies etc.) and wash sheets, cushion covers, mattress covers and blankets at a temperature above 60 °C to fight mites;*
- *use lockers for children's coats to avoid bringing allergens like dog hair into the classroom from home.*



Improves indoor air with “eating poisons” plants

Inspired by the ability of nature to maintain clean air, scientists at NASA, during studies on recycling indoor air, they investigated the effects of biological processes of plants on the indoor environment. They discovered that some house plants cause significant reductions in the level of indoor pollution.

Then in 1980 in the John C. Stennis NASA space center, it was discovered that houseplants were able to eliminate the chemicals in experimental rooms. From this experience, the Associated Landscape Contractors of America jointly with NASA to launch a two-year study to evaluate the effectiveness of 12 species of common indoor home plants for abatement of formaldehyde, benzene and trichlorethylene in isolated environments. Although the studies were aimed at exploring possible solutions for the removal of these substances for space navy stations, their application in living society was realized quickly.

The more effective species are: Gerbera, chrysanthemum, chlorophyta, smoke absorbing plants, Sanseveria, philodendrons, pothos particularly the Schefflera is an excellent detector of unhealthy air because it gives immediate signs of distress in the presence of pollutants. The philodendro instead is quite strong, surviving in unhealthy working environments.



Some examples of house plants able to act on indoor pollutant concentrations

Nephrolepis exaltata	Takes away from environment 20 µg/h of formaldehyde concentration.
Chrysalidocarpus lutescens	Takes away from environment 19 µg/h of xylene and toluene concentration.
Spathyphyllum wallisii	Takes away from environment 19 µg/h of acetone, 13 of methanol, 7 of benzene, 5 for ammonia and 3 of formaldehyde.
Chlorophytum comosum “vittatum”	Takes away from environment 7 µg/h of formaldehyde concentration.
Anthurium andreanum	Takes away from environment 10 µg/h of ammonia, 8 µg/h of xylene e toluene concentration.
Ficus benjamina	Takes away from environment 12 µg/h of formaldehyde concentration.

For further details on house plants, please see also annexed CD

WHAT TO DO IN CASE OF BUILDING RENOVATION

✓ Against the “stuffy” air

- *Provide classrooms with appropriate surfaces and volumes (about 1.80 sq m per pupil for nursery, primary and secondary schools);*
- *install air conditioners equipped with HEPA filters that can filter more than 99.9 percent of dust particles greater than 0.1 - 0.3 micrometer, that is fine particles, dust, eggs mites, pollen, smoke particles, asbestos, bacteria, and aerosols;*
- *incorporate sustainable design or “healthy buildings”;*
- *improve energy efficiency of school buildings through energy certification, but do not impair adequate ventilation.*

✓ To combat dust

- *Build smooth walls, avoid wall to wall carpet or toxic floor materials;*
- *use furniture with smooth surface to improve cleaning and prevent dust build up;*
- *try to avoid indoor tissue curtains, in case use smooth fabric easy to wash; for sunlight protection prefer outdoor ones.*

✓ To fight chemicals

- *Avoid the use of toxic or special paints (see photocatalytic in annex);*
- *paint when the school is closed;*
- *leave new furniture in empty classrooms (school summer break) to avoid exposure to VOCs (formaldehyde, toluene etc.);*
- *avoid materials that emit strong odours or that contain formaldehyde;*
- *provide adequate ventilation in school kitchens;*
- *choose furniture made of metal or wood without irritants such as paints or glues.*



✓ **To fight allergens**

- *Provide environmental control measures against mites and mould.*

Do you know you can help indoor air quality also by using the right paint?

Among the remedies for chemicals abatement the application of photochemical technology to construction materials must be mentioned. Photochemistry that underlies the formation of secondary pollution can be used to reduce air pollutants.

It can be applied to a building material substance “photocatalyst” that through the action of light transforms polluted materials into harmless ones. Photocatalysis accelerates natural oxidation processes favoring the decomposition of pollutants, which, through a reaction of photo-oxidation, are transformed into common inorganic salts, leached in water. This technology can be applied to building materials.



The main benefits we expect from an extensive use of photocatalytic materials are:

AIR PURIFICATION

BUILDING AESTHETICS

DEODORANT ACTION

ANTIMYCOTIC ACTION

FIRE RESISTANT



These paintings promote the purification of air using the natural properties of ozone. The chemical process sees the ozone change in oxygen under the action of solar radiation. The active oxygen then reacts with water to form hydroxyl radicals, whose degradation subproducts is removed by the atmosphere. Another useful photocatalytic material is titanium dioxide (TiO_2). It can be applied to cementitious materials, but also paints, plasters and mortars and can abate between 20 and 70% of pollutants according to several factors like solar radiation, and of course the type of pollutants.

The eco-coating associated with light sources allows the use of such techniques in indoor environments also. The technique is very easy to be used and could represent a relevant contribution to the solution of indoor environment pollution without any technological intervention.

Converts pollutant substances into harmless residues

Reduces buildings' that are dirty from pollution (nitrogen oxides and benzene abatement, fat decomposition, dust deposition, rain and other factors)

Decomposition of toxic organic gasses perceived by smell

Abatement of bacteria and fungi

Flame retardant

For further details on special paint, please see also annexed CD

3.4 ALLERGIC AND ASTHMATIC CHILDREN HAVE THE RIGHT TO GO TO SCHOOL: HOW TO TACKLE THE PROBLEM TOGETHER

Talking about allergic and asthmatic disorders management means establishing a complex and personalised programme which facilitates the implementation of therapeutic, behavioural and environmental rules to ensure the best treatment of these illnesses. In order to achieve this, all the key people around the child and his or her family should be actively involved.

From this point of view, school staff and classmates can and must contribute actively to the effective management of these conditions. Proper management of problems associated with allergies requires not only the implementation of environmental standards, but above all proper understanding and behaviour by school staff and classmates in order to allow allergic and asthmatic children, if properly treated by a medical specialist, to lead normal school lives.

It would be best to ensure regulated training activities for school personnel with the aim of ensuring healthy air quality and the provision of pharmaceutical remedies during school hours to avoid the consequences of allergic and asthmatic attacks.

Decision makers and health organisations should facilitate methods, instruments and resources to allow emergency medical treatments in the school environment by planning initiatives to achieve these educational goals.

Initiatives for schools staff and personnel

Will provide knowledge and awareness on:

- a) allergic and asthma disorders;
- b) the importance of preventive measures to be implemented in order to avoid allergic and asthmatic attacks;
- c) the importance and necessity for early provision of medical treatment;
- d) early signs of asthma attacks or allergic reactions;
- e) the need for emergency medical care.

Classroom and parental

Initiatives aimed at:

- a) promoting a healthy culture in order to help children affected by asthma and allergies and to help their classmates to understand and accept their similarities and differences;
- b) providing understanding through appropriate, age-adjusted means of communication allowing classroom groups to be able to think about the events, problems and difficulties of more vulnerable peers;
- c) facilitate contacts and socialisation with allergic and asthmatic children.

Asthmatic and allergic children should have the opportunity to be involved in all activities and be helped to accept their illness as an everyday fact of life

The understanding, definition and implementation of rules and recommendations should be considered necessary and essential to ensure:

1. full integration of children into teaching and extra-curricular activities;
2. a reduction in allergic reactions during school hours and consequent reductions in the need for healthcare interventions;
3. a reduction in school absences;
4. the well-being and happiness of the entire school population, including children affected by these pathologies, their families, school staff and the entire classmate group.

In order to achieve these goals, it is essential, beyond respecting legal standards, to define clearly roles and responsibilities. Equally important and necessary is the willingness to share the commitment to actively cooperate in the enforcement of rights, freedom and diversity of everybody. Disease management and preventive feasible actions in schools that have received little attention to date should be considered beneficial to the entire school community because it is important to stress that a suitable environment for children with asthma and allergy is a healthier environment for all.

CONCLUSIONS

Indoor air is a complex mixture of chemical, biological and physical factors that interact synergistically and may undermine the respiratory health of children.

Among the indoor environments, the school is of particular interest because children spend most of their time there and are unaware of the risks to their health. In addition, in many countries the school environment is often poorly regulated compared to other workplaces.

But a healthy school is not only a problem of environmental standards and health surveillance because of the complexity of risk factors and individuals responsibility for health determinants.

The value of projects such as SEARCH goes beyond the environment and health assessments.



In the Italian experience, although the national figures cannot be considered alarming, difficulties encountered in the project planning has, however, highlighted the strengths and weaknesses of the management and prevention systems, including the fragmentation and clarity of roles of local authorities, accompanied by scarcity of resources for school building management.

The role of different sectors (mobility, energy, business, green areas and school construction management) and different national and local authorities involved in the management of a healthy environment in school is essential but should be done along with a process of awareness of problems and available solutions. This is especially true for those involved in the frontline of putting in place those apparently small actions that, together, will define the vitality of preventative measures at the local level.

Is known from experience that when there is a confrontation with multifactorial, complex problems, the presence of local legislation, while important, is not the only tool available for effective implementation of the objectives of environment and health prevention.

To realize them or to make possible the simple suggestions and recommendations suggested in this brief booklet (as for the choice of furniture and teaching materials or for the integration of asthmatic children in extracurricular activities), in addition to risks knowledge awareness must be raised of the importance of individual roles (school staff and faculty, family and especially children allergic asthma, pediatricians, environmental professionals, trade associations), providing mechanisms and tools to facilitate the exchange of information and local initiatives.

**It is a right of children to go to school;
protecting their health is a duty for all.**

