Interreg CENTRAL EUROPE

InAirQ

European Union
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Development Fund

TRANSNATIONAL ADAPTION ACTIONS FOR INTEGRATED INDOOR AIR QUALITY MANAGEMENT

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THE ROAD TO THE JOINT TRANSNATIONAL STRATEGY FOR BETTER INDOOR AIR QUALITY: THE MONITORING CAMPAIGN

InAirQ project is now in its second year.
In this newsletter we will report the project advancements and the meetings that took place, as well as the future activities.

The InAirQ monitoring campaigns have started in the countries participating to the project. The campaigns are conducted in the 12 selected schools in each country and are aimed at identifying the main airborne pollutants able to affect the health of the children. The monitoring campaigns are conducted for 5 days (a week) in each of the selected schools. Thus, the monitoring campaign will last for 12 weeks during the heating period.
Following, a concise overview of the pollutants to be monitored and their effects on human health are presented.

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INDOOR AIR QUALITY IN SCHOOLS

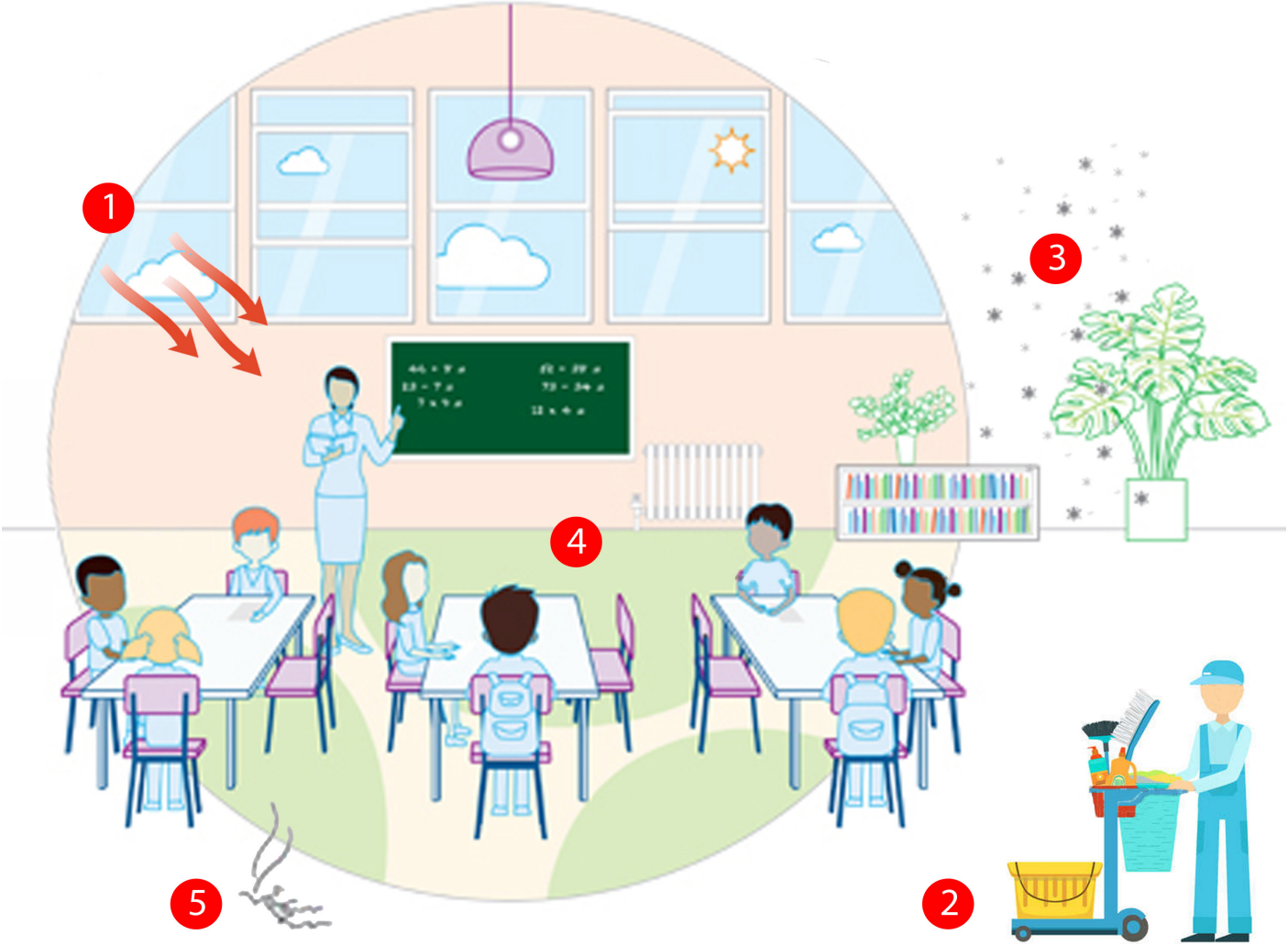
The air quality inside school buildings, where students spend an average of 5 to 8 hours per day, is often a major cause of respiratory diseases (rhinitis, allergies, asthma, respiratory infections). Dust, mold, pollen, dust mites and other air pollutants are among the causes of respiratory problems found in students, teachers, workers.

Often incorrect air replacement methods and procurement procedures for furniture, building cleaning and maintenance services, which do not take into account the air quality implications of the materials used, contribute to the unhealthy indoor air supply. Furthermore, recent studies have shown with increasing evidence the high correlation between between respiratory diseases, cardiovascular morbidity and high levels of air pollution, especially in relation to the concentration of fine particles.

Often the pollutants are brought into the classes by the students themselves (low-quality components of clothing, backpacks, paints, boots, etc.).

An overview of the most relevant indoor air pollutants:

1: Carbon monoxide, nitrogen dioxide, particulate (combustion gases from vehicles, etc.)
2: Chemicals (cleaning products, furnishings, etc.)
3: Pollens, powder, allergenes
4: Moisture
5: Radon gas



THE POLLUTANTS

VOLATILE ORGANIC COMPOUNDS (VOCS)

Volatile organic compounds are a broad category of of low-molecular weigh compounds and are characterised by their high volatility (ability to evaporate) at normal room temperature and pressure. A wide variety of man-made and natural sources contribute to VOC levels indoors and outdoors.

VOCs are typically found in building materials, cleaners, solvents, paints, gasoline, office equipment such as copiers and printers, correction fluids and carbonless copy paper, and graphics and craft materials, including glues, adhesives and permanent markers; all of these materials are rather common to be found in a school. More commonly known VOCs include benzene, toluene, methylene chloride, trichloroethylene, and tetrachloroethylene.

Exposure to VOCs can result in both acute and chronic health effects, depending on many factors such as the toxicity of the compound, the level and the length of exposure. A few VOCs, such as benzene, have been directly linked to cancer in humans, and others are suspected of causing cancer.

ALDEHYDES

Aldehydes are one of the most important groups of indoor air pollutants (relevant compounds are: formaldehyde, acetaldehyde, acroleine, propion-aldehyde, benzal-dehyde, hexanal, glutaraldehyde). Indoor sources of aldehydes are numerous and include furniture and wood-pressed products such as particleboard, plywood and medium-density fibreboard; insulating materials; textiles; paints, wallpapers, glues, adhesives, varnishes and lacquers; household cleaning products such as detergents, disinfectants, softeners, carpet cleaners and shoe products; cosmetics such as liquid soaps and shampoos; electronic equipment, including computers and photocopiers; and other consumer items such as insecticides and paper products.

Again, many of these sources of aldehydes are present in schools.

Aldehydes can be strong irritants.

Moreover, formaldehyde and acetaldehyde have been classified by the World Health Organisation as probably and potentially causing cancer, respectively.

Symptoms such as sensory irritation to the eyes and upper airways, headache, coughing, respiratory symptoms (e.g. allergy), lung effects (asthma and allergy) and eczema can occur in the presence of aldehydes in the indoor air.

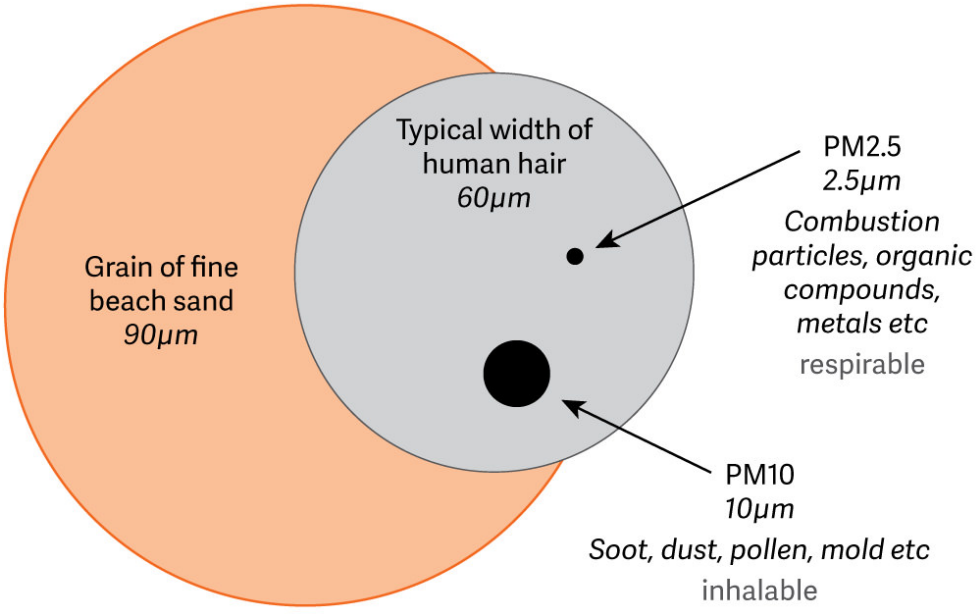
Other symptoms that may arise consist of headaches, fatigue, cough and attention disorders, nasal epithelium irritation and allergies with the appearance of bronchial asthma immune-mediated (i.e. backed by a reaction of the immune system).

THE POLLUTANTS

PARTICULATE MATTER (PM_{10}, $PM_{2.5}$)

The particulate matter consists of the whole of all the non-gaseous material suspended in the air.
The nature of the aero-dispersed particles is very varied: they include combustion products, organic material dispersed by plants (pollen and fragments of plants), crustal material produced by natural agents (wind and rain), or by soil erosion or from manufactured articles.
In urban areas, the particulate material may originate from industrial processes (construction sites, foundries, cement works), from the wear of asphalt, tires, brakes and clutches and exhaust emissions from motor vehicles, especially those with Diesel engines.
The urban vehicular traffic contributes considerably to air pollution with the emission of soot, organic compounds, trace elements and unburnt particles of various kinds.
The surface of the emitted particles can adsorb harmful gaseous air pollutants.
$PM_{2.5}$, or "fine particles", refers to particles that are 2.5 microns in diameter or less, while PM_{10} is defined as the fraction of particles with an aerodynamic diameter smaller than 10 microns. At schools, indoor concentrations of particulate matter have been shown to be highly correlated with outdoor levels, suggesting that indoor particles are largely of outdoor origin. This indoor penetration of outdoor particles depends not only on the physical barriers of the building and ventilation (natural or mechanical), but also on particle physico-chemical properties and size.
The health risk associated with substances found in the air in the form of suspended particles depends not only on their concentration, also on the size of the particles themselves. The smaller particles pose a greater danger to human health, as they can penetrate deep into the respiratory tract.
As a first approximation:

- particles with a diameter of more than 10 microns stop in the upper respiratory tract;
- the particles with a diameter between 5 and 10 microns reach the trachea and the bronchi;
- particles with a diameter of less than 5 microns can reach the pulmonary alveoli.



Epidemiological studies have shown a correlation between particulate matter concentrations in air and the manifestation of chronic diseases of the respiratory tract, in particular asthma, bronchitis, emphysema.
In terms of indirect effects, in addition, the particulate acts as a vehicle for substances with high toxicity, such as polycyclic aromatic hydrocarbons.

THE POLLUTANTS

NITROGEN OXIDES

Nitrogen oxides (NO, N_2O, NO_2, NO_X and others) are generated by all combustion processes, whatever fuel is used.
Nitrogen dioxide (NO_2) appears as a reddish-brown gas with a strong, pungent smell. It can be considered one of the most dangerous atmospheric pollutants, both for its irritating nature, and because in conditions of strong solar irradiation it causes secondary photochemical reactions that create other polluting substances (photochemical smog). The exhaust fumes of vehicles contribute enormously to NO_2 pollution; the amount of emissions depends on the characteristics of the engine and the mode of its use (speed, acceleration, etc.). In general, the presence of NO_2 increases when the engine operates at high revolutions (fast-flowing urban arteries, motorways, etc.).
Nitrogen dioxide is a toxic gas irritant to mucous membranes and responsible for specific pathologies affecting the respiratory system (bronchitis, allergies, irritations).
Like CO, also NO_2 acts on haemoglobin, oxidizing the iron of haemoglobin which loses its ability to transport oxygen.
Among other effects, the nitrogen oxides contribute to the formation of acid rain, thus causing the alteration of environmental ecological balances.

OZONE (O_3)

Ozone is a highly reactive gas with a pungent odour and a strong oxidizing power. At high concentrations it takes on a blue colour.
The ozone is concentrated in the stratosphere at a height between 30 and 50 km from the ground; its presence protects the troposphere from ultraviolet radiations emitted by the sun and harmful to the life of living beings. The absence of ozone in the stratosphere is generally called the “ozone hole”.
The ozone present in the troposphere (the atmospheric layer between the sea level and 10 km of altitude), and in particular in the immediate vicinity of the earth’s surface, is instead a component of the “photochemical smog”, which originates mainly in the summer months in concomitance of intense solar radiation and high temperatures.
Ozone has no direct sources, but is formed within a cycle of photochemical reactions involving in particular the nitrogen oxides.
Relatively low concentrations of ozone cause effects such as irritation of the throat and respiratory tract and burning of the eyes; higher concentrations may lead to changes in respiratory function and increased frequency of asthmatic attacks.
Ozone is also responsible for damage to vegetation and crops, with the disappearance of some tree species from urban areas.
Some plant species particularly sensitive to the concentration of ozone in the atmosphere (Ligustrum ovalifolium, Hedera helix, Japanese cabbage) are sometimes used as bioindicators of the presence of photochemical smog.

THE POLLUTANTS

CARBON MONOXIDE (CO)

CO is the most abundant gaseous pollutant in the atmosphere, its concentration is higher than the other air pollutants of outdoor origin and its concentration is expressed in milligrams per cubic meter. It is an odourless and colourless gas and is generated during the combustion of organic materials when the amount of oxygen available is insufficient.
The main source of CO is represented by vehicular traffic (about 80% of global emissions), in particular from the exhaust gases of gasoline vehicles (especially non-catalysed vehicles with two-stroke engines).
The concentration of CO emitted by vehicle exhausts is strictly connected to engine operating conditions: higher concentrations are recorded with engine idling, typical conditions of intense and slowed urban traffic and deceleration.
Carbon monoxide poisoning occurs when one breathes in even small amounts of the gas. It gets into blood stream and prevents red blood cells from carrying oxygen. Without oxygen, the body tissue and cells die. Levels that do not kill can cause serious harm to health when breathed in over a long period of time. Long term effects of carbon monoxide poisoning include paralysis and brain damage.

CARBON DIOXIDE (CO_2)

Carbon dioxide is an acid oxide (anhydride) formed by a carbon atom linked to two oxygen atoms. Considered to be one of the main greenhouse gases present in the earth's atmosphere, it is a fundamental substance in the vital processes of plants and animals. It is essential for the life and for the photosynthesis of plants, but it is also responsible for the increase in the greenhouse effect.
Carbon dioxide levels in the classroom have been shown to be directly related to a students alertness and ability to concentrate. High levels of carbon dioxide indicate a lack of fresh air intake and that negatively affects the health, attendance rate and learning ability of students.


Joseph Ducreux, self-portrait c. 1783

EVENTS

THIRD WORK GROUP MEETING

26-27|09|17

TURIN
ITALY

The third Work Group meeting took place in Turin, Italy on 26th and 27th of September, 2017, and was hosted by SiTI - Istituto Superiore sui Sistemi Territoriali per l'Innovazione.
During the same days the midterm international conference has been organised.
Project partners invited community representatives and panelists from health and educational sector and other policy bodies for a roundtable talk, in order to discuss the project themes.

BENCHMARK VISIT

29-30|11|17

VIENNA, GRAZ
AUSTRIA

On 29th the project partners visited the school Childcare centre Maria Enzersdorf near Vienna. On 30th November 2017 project partners visited two school buildings in Graz: Volksschule Graz-Mariagrun and Primary School Hausmamstaaten.

The school has been selected as representative of European best practices, and significant from the point of view of the issues emerged from the SWOT analysys compiled during InAirQ project, thus focusing on ventilation systems and indoor air quality.

EVENTS

UPCOMING EVENTS

24-25|04|18

LODZ
POLAND

The fourth Work Group meeting will take place in Lodz by on the 24th - 25th of April, 2018, and will be hosted by the Nofer Institute of Occupational Medicine and the Marshall Office of Lodzkie Region.

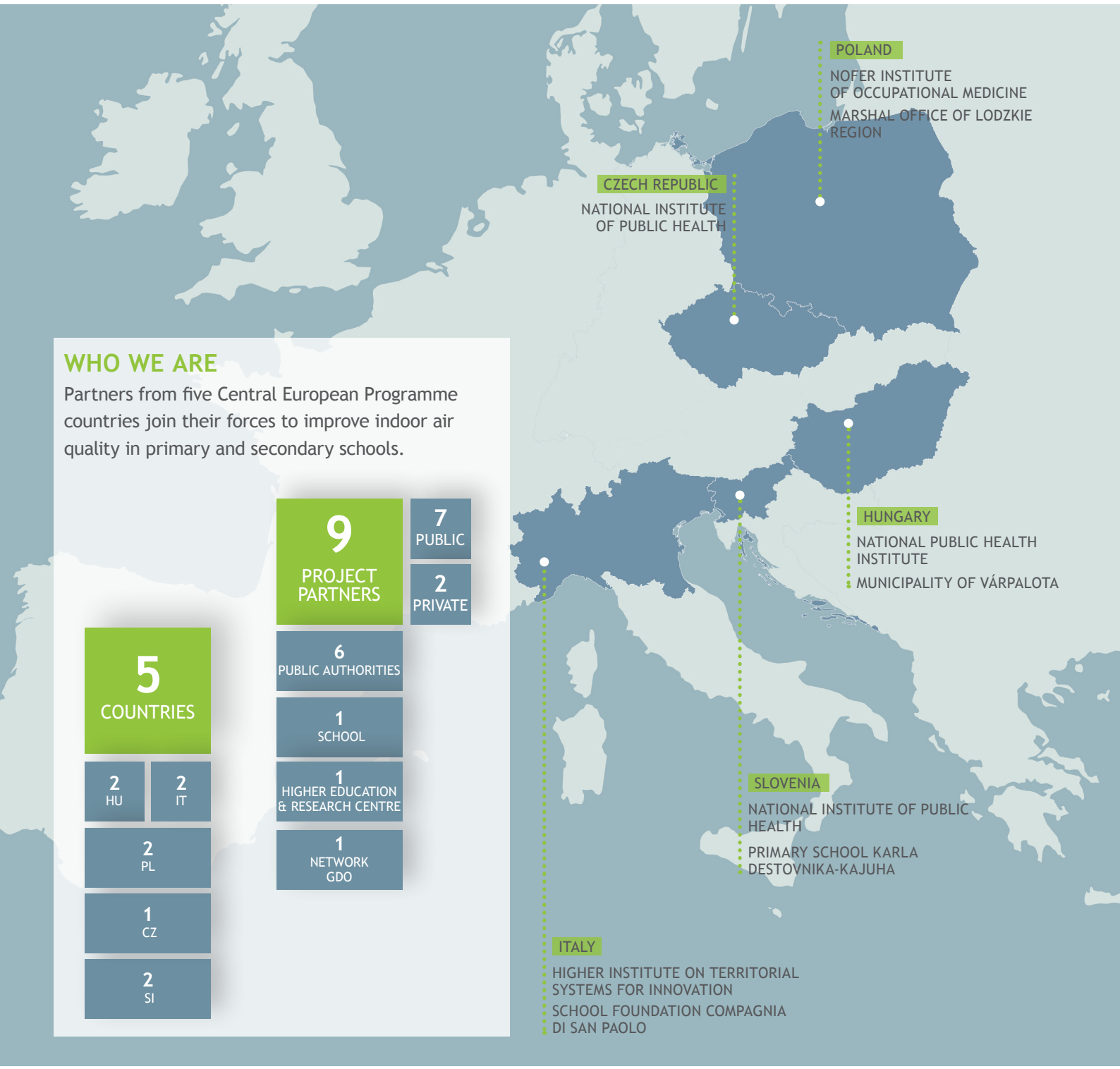
UPCOMING BENCHMARK VISIT

21-24|05|18

HELSINKI
FINLAND

The second Benchmark visit will take place in Finland, between 21st and 24th May 2018. The work group will visit a series of schools in Sipoo and Espoo, towns near Helsinki, in order to gather information about the best practices adopted for the improvement of indoor air quality.

THE INAIRQ PARTNERS



WHO WE ARE

Partners from five Central European Programme countries join their forces to improve indoor air quality in primary and secondary schools.

9 PROJECT PARTNERS

- **7** PUBLIC
- **2** PRIVATE

- **6** PUBLIC AUTHORITIES
- **1** SCHOOL
- **1** HIGHER EDUCATION & RESEARCH CENTRE
- **1** NETWORK GDO

5 COUNTRIES

- **2** HU
- **2** IT
- **2** PL
- **1** CZ
- **2** SI

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- National Institute of Public Health
- Municipality of Várpalota
- Slovenian National Institute of Public Health
- Higher Institute on Territorial Systems for Innovation
- Nofer Institute of Occupational Medicine
- Primary School Karla Destovnika-Kajuha
- School Foundation Compagnia di San Paolo

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