Air pollutants transfer from road in the schools of Lille

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Objectives of the project

The City of Lille has launched a project, Sco’Air, relating to the improvement of air quality in schools in PRSE2. The Cerema and Atmo Nord-Pas-de-Calais undertook specific measurements in two schools in Lille. The objective of the Cerema team is to study the relation between outdoor air pollution and indoor air quality in order to recommend better practices for improving air quality. Two schools were selected for this study according to their road pollutants exposure and building properties.

Indoor air quality is a subject of concern for the following reasons:
- • time spent in closed premises (homes, offices, schools or public buildings) is largely superior to time spent outdoors (about 90%)
- • certain categories of people (pregnant women, children...) are highly sensitive to toxic pollutants
- • the number and variety of pollutants from domestic sources are very important and some of them are difficult to identify

Various parameters govern the transfer process:
- • outdoor levels
- • weather conditions: season, temperature, humidity, atmospheric pressure
- • building internal factors: process on material surfaces, air tightness
- • ventilation: air exchange rate
- • occupant behaviours: tobacco smoke, cooking
- • physical and chemical properties of pollutants: reactivity, deposition, size of particles

Schools selection

Two schools were chosen to be measured by Atmo Nord-Pas-de-Calais and Cerema: Thierry Launay school and Buisson Briand school. The following criteria for the choice were:
- • feasibility of the project as a whole within the school (metropole but also educational project, which the teaching staff took on board)
- • geographical exposure to air pollution: use of urban modelling platform
- • building characteristics: age, ventilation, type of opening

The pollutants selected for the study, based on several references and technical and financial feasibility criteria were: NO2, O3, PM10, and PM2.5 as well as weather conditions (wind direction and speed, temperature and humidity...). We chose to use Airpointer® which can measure multi-parameters simultaneously with reference methods. Comfort parameters such as temperature, humidity, and carbon dioxide, have also been measured by Atmo Nord-Pas-de-Calais. Analyzers nephelometers ADR-1500 and PDR-1500 were used enabling real-time measurement of the mass concentration of airborne dust in the air for PM2.5.

Air permeability was measured to have a result on the air exchange rate of the instrumented classroom.

Materials

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Relation between indoor/outdoor concentrations for NO2

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Study limitations

- • Breakdowns of sensors due to a power cuts on Thierry Launay school did not allow to collect all data
- • Short period of measures for this first investigation which prevented from having all the weather conditions and only one class per school has been equipped with sensors

Conclusion

- • Respect of the different air standards in Thierry Launay school for NO2 and PM10 and in Briad Buisson school during winter for NO2 and PM10
- • Non respect of the different air standards in Briad Buisson school during summer for NO2 and PM10
- • Particle levels are subject to net increases at certain times of the day corresponding to movements (breaks, cleaners,...) => resuspension of particles
- • Influence of the proximity to highways (A25) and old design (single glazing and no mechanical ventilation system) for Thierry Launay school
- • Indoor and outdoor levels profile of PM2.5 are similar

A new innovative approach in 2017

To follow up this project, a new one has been submitted with fundings from the DREAL Hauts-de-France, in collaboration with the City of Lille. This new approach is based on an innovative sensor technology for the measurement of pollutants and acoustic parameters and accompanied with four classes and two external sites equipped (Tera group devices) in three schools in Lille. The pollutants measured are:
- • In outdoor air: nitrogen dioxide, ozone, particulate matter (PM10 and PM2.5), acoustic and weather parameters
- • In indoor environment: total VOCs, formaldehyde, nitrogen dioxide, ozone, particulate matter (PM10 and PM2.5), acoustic parameters, CO2 and comfort parameters

This work will define and establish air quality and noise indicators for children in the three schools with different characteristics and road/industrial exposure. The objective is to have information about air quality and noise co-exposure. This work should be extended to other communities or other types of buildings.

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