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Prague Intervention Study

B. Kotlík, H. Kazmarová, M. Mikešová, V. Vrbíková, L. Kuklová

Centre for Health and the Environment, National Institute of Public Health Prague, Czech Republic

Introduction

Results and discussion

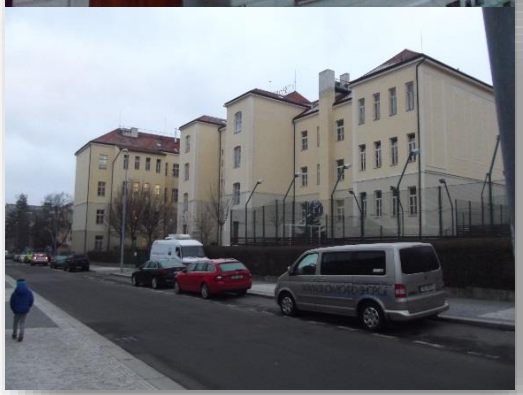
Conclusion

CZECH INTERVENTION STUDY

Task - description of the potential impact of transport on the indoor environment at schools and proposal / verification of possible measures.

DESCRIPTION OF THE SCHOOL

Main entrance



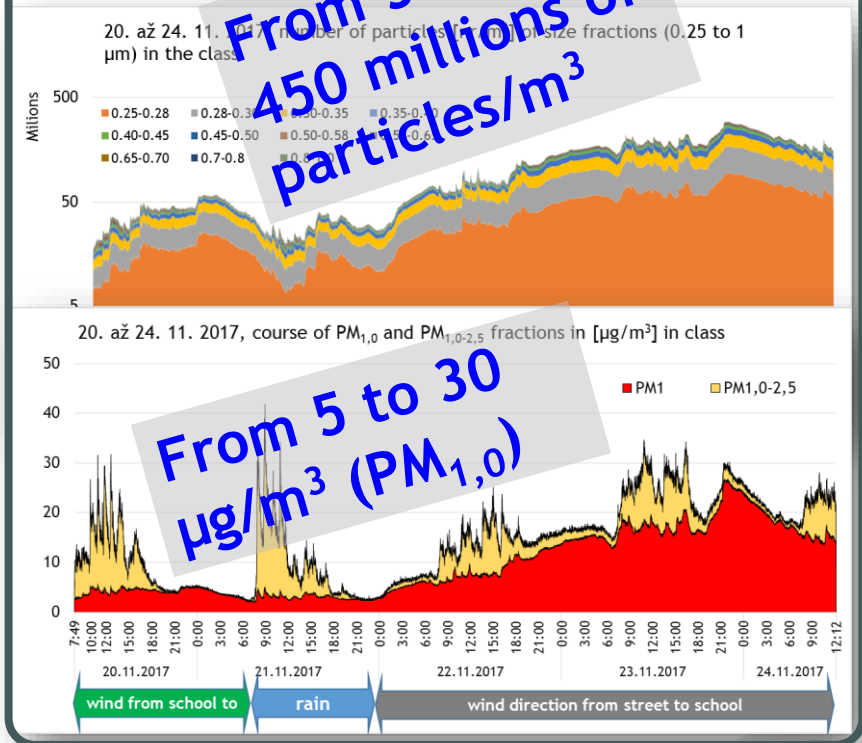
Courtyard

- The 5 storey school building was built from brick and stone in 1910 and has not undergone a complete reconstruction.
- The wiring, lighting, water pipes and classrooms have all been partially reconstructed.
- Heating is central with radiators.
- Air conditioning and mechanical ventilation is installed in certain parts of the building only.

WHAT WE KNEW FROM WEEKLY MEASUREMENTS IN SCHOOLS

1. There was no problem with radon, metals and organic compounds at any **school**.
2. In the **ambient air** benzene, carbon monoxide and sulfur dioxide were no problems.
3. **School** excesses occurred in dust (especially $PM_{10-2.5}$) and in (dis)comfort parameters, i.e. relative humidity, temperature and air exchange (CO_2 as indicator).
4. The influence of the **surrounding traffic** load was manifested by nitrogen oxides and dust - $PM_{2.5}$ fraction and submicron fraction.

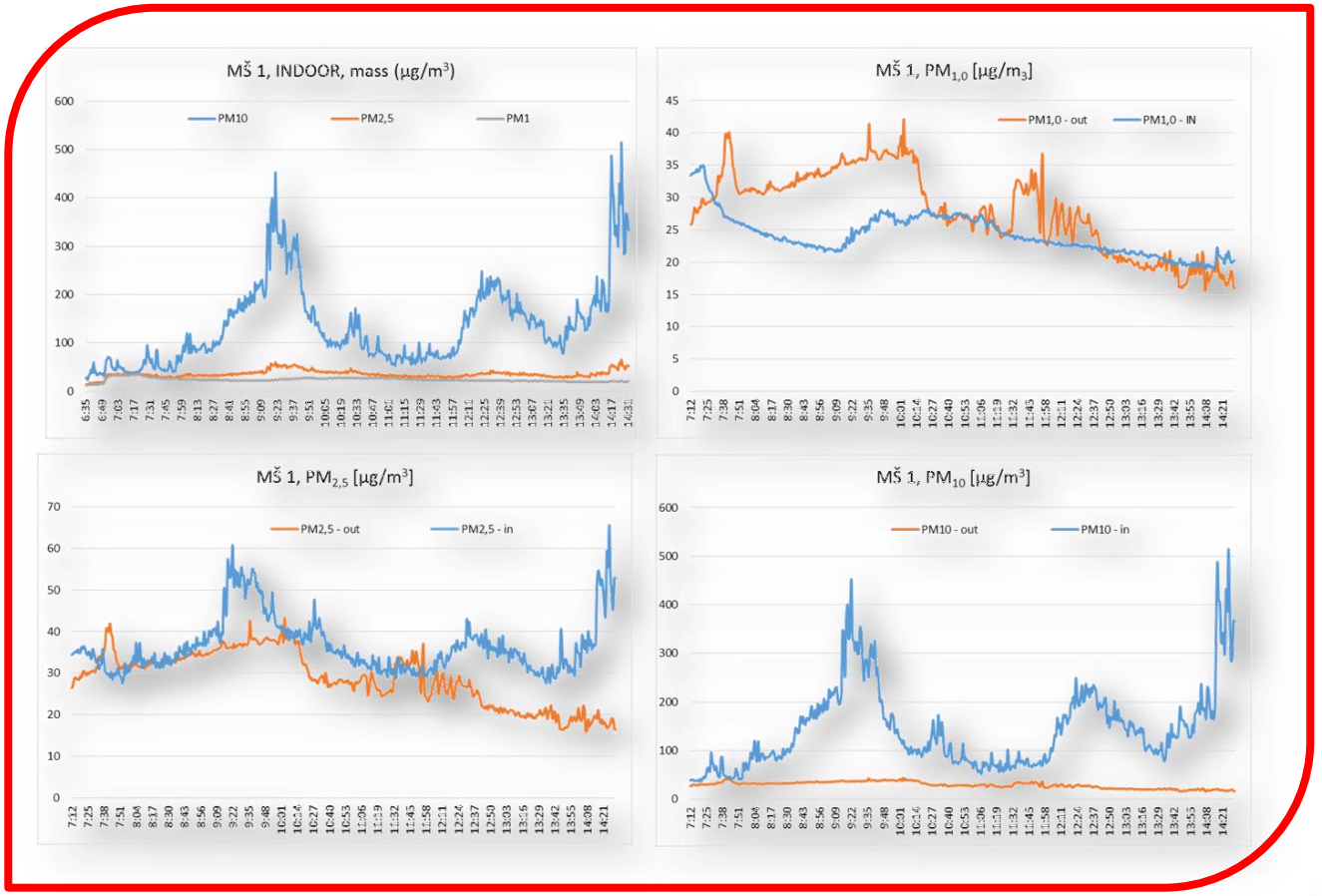
Example: The influence of the nearby communications on the measured dust concentration in classroom



DUST IN INDOOR ENVIRONMENT

From previous studies, it was clear that:

- The $PM_{2.5-10}$ coarse fraction comes mostly from children's activities in the area,
- Conversely, the submicron fraction $PM_{1.0}$ comes mostly from the ambient air
- And the $PM_{1.0-2.5}$ fraction basically represents both effects



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METHODIC

The study had three parts

1. Research and description of load intensity around the school
2. Long-term (80 days) parallel measurements in 12 classes

   The sensors were placed in 12 classrooms in the school, limiting factors were the safety of children (and sensors) and availability of electricity.

3. Testing of proposed measures

SELECTED SCHOOL

This school is situated in an urban locality with heavy traffic load. (category 5, combination of local and central heating systems in the vicinity and traffic load 5 -10 thousand cars/24 hours.)

- ✓ On the busy road with tramlines
- ✓ 300 meters from the school is another major road, Patočkova Street, which connects the Prague circuit with the city center.
- ✓ Portals of the Strahov and Blanka tunnels are both located nearby

  (together more than 85 thousand car/24 hrs.)

SITUATION AROUND THE SCHOOL

The Strahov and Blanka tunnels

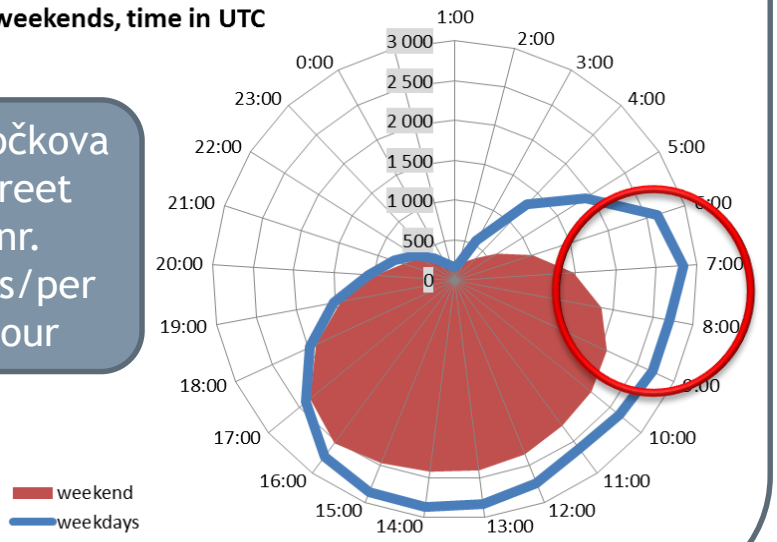
Patočkova Street, and other communications with intensive traffic

Measuring station CHMI

NEIGHBORING TRAFFIC INTENSITY

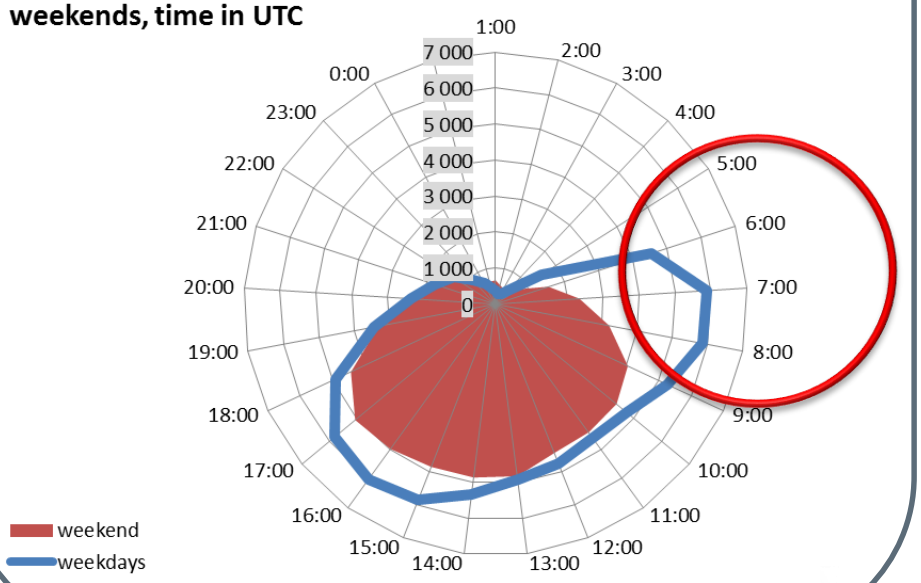
Patočkova street nr. cars/per hour

Patočkova street, 17. 2. až 16. 3. 2017 the average traffic intensity, weekdays and weekends, time in UTC



Tunnel Blanka nr. cars/per hour

Portal Troja, 1. 2. až 28. 2. 2017 the average traffic intensity, weekdays and weekends, time in UTC

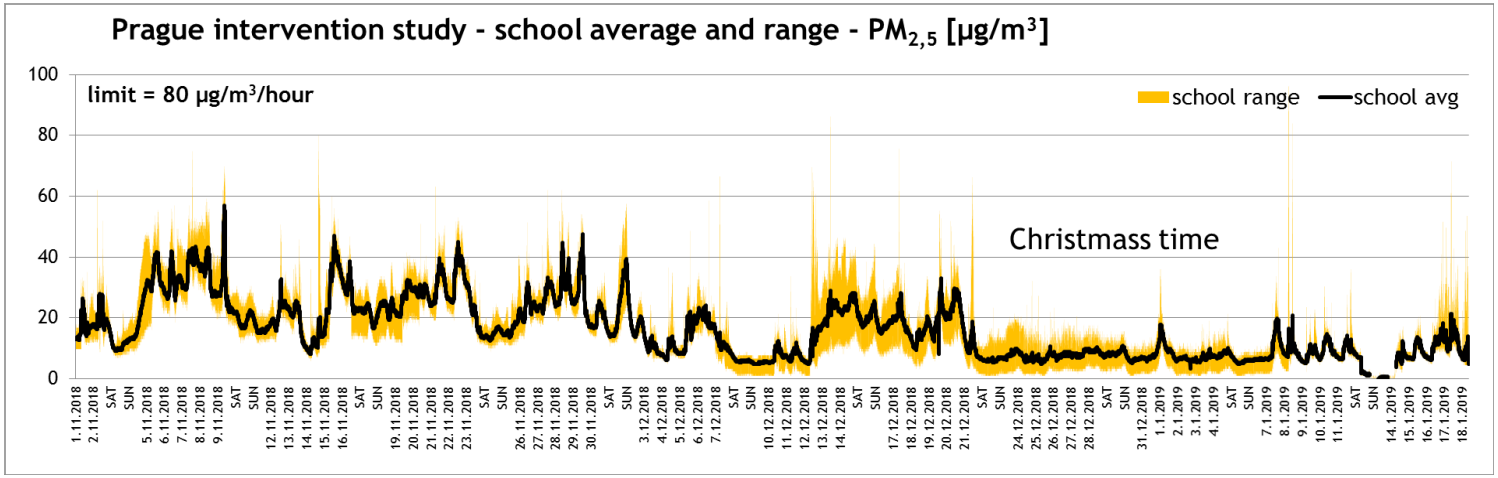


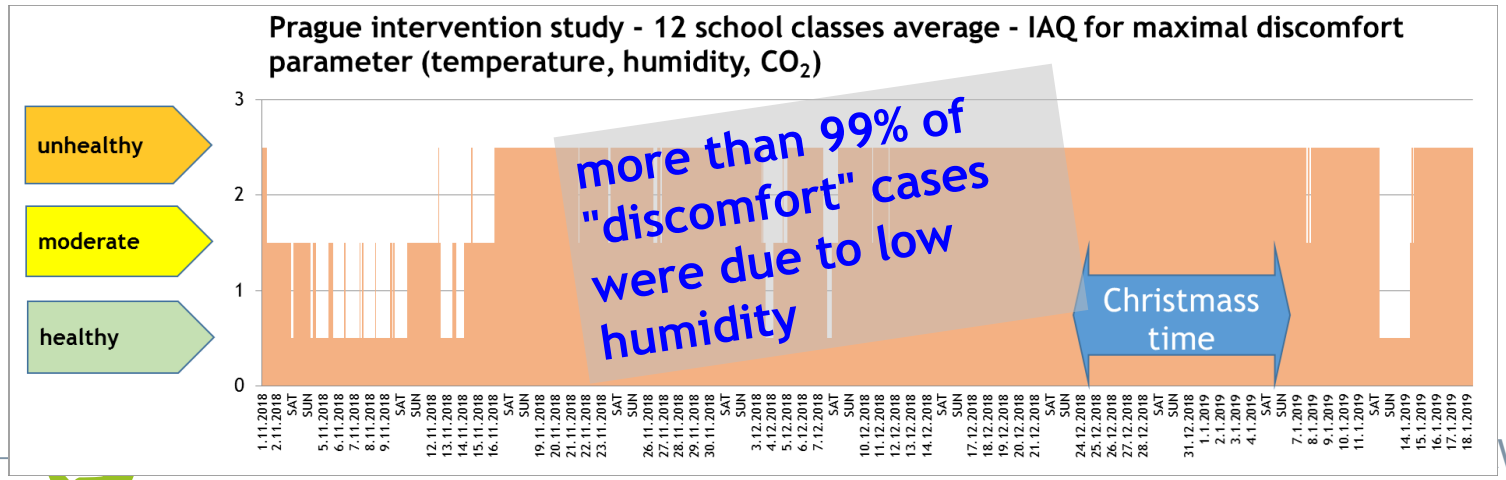
The high traffic load culminates just at the time of the arrival of the children at school (7 - 8 am) and is further increased throughout the teaching period.

RESULTS

Long term measurement in 12 classes

(from 1st of November 2018 to 20th of January 2019)





PROBLEMS AND RELATED QUESTIONS

Problems:

1. Ensuring communication and fluent data transfer
2. Data validation (blackouts, children's creativity ….)
3. Sensors lifetime / sensor faults (dust measurement)

Questions:

Representativeness of measurement

   a. Space description (?)
   b. Values in individual classes x average for the whole school

PROPOSAL OF POSSIBLE MEASURES

We knew that there was not possible to influence the surrounding traffic load. Therefore, we focused solely on possible measures in the classrooms.

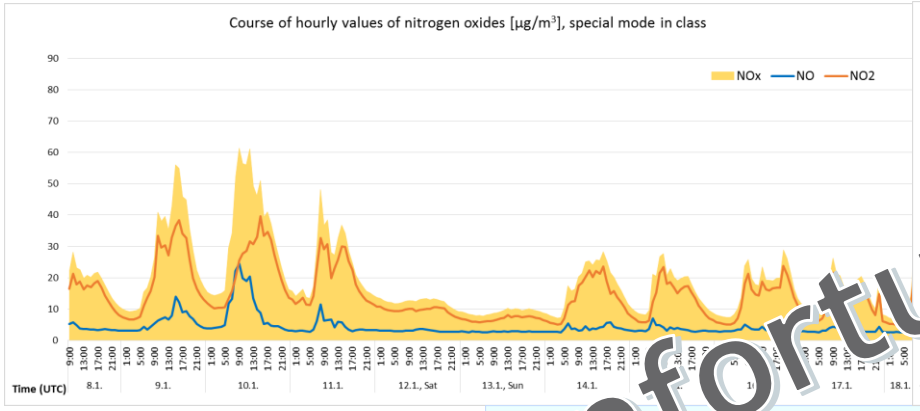
Basic rules for ventilation, thermal climate and cleaning

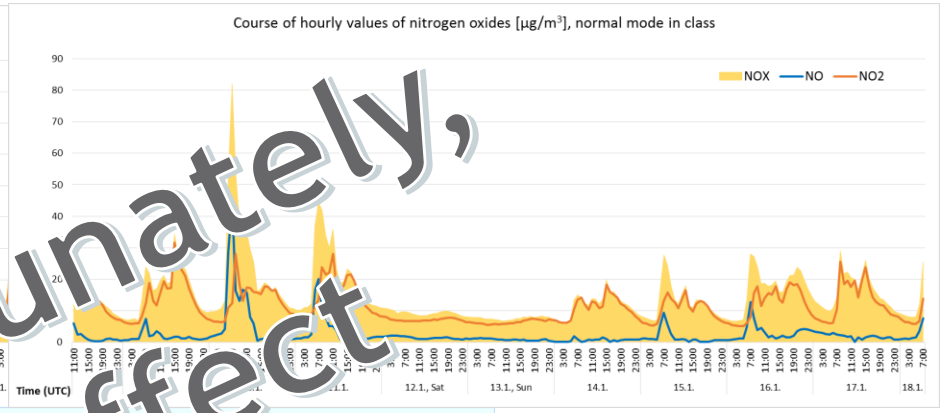
1. In the morning, **before the pupils arrive**, ventilate through the corridor through the door (open the courtyard window in the corridor).
2. **Further up to 10 am** ventilate this way at least 2x during each lesson.
3. **From 10 am** ventilate 2x during each lesson already through windows to the Bělohorská street.
4. **Each break** wentilate through the door to the corridor.
5. During the teaching at least 2x **check the temperature** in the class, keep the temperature between 20 - 24 °C.
6. Only **wet cleaning** of the board!
7. Children must use **only school shoes**!
8. Cleaning every day **after** classes end

- only **wet** and with the **minimum** amount of detergent required.
- wiping furniture, benches and window sills, wiping the floor
- vacuuming the carpet (if in the classroom) **windows must be open**

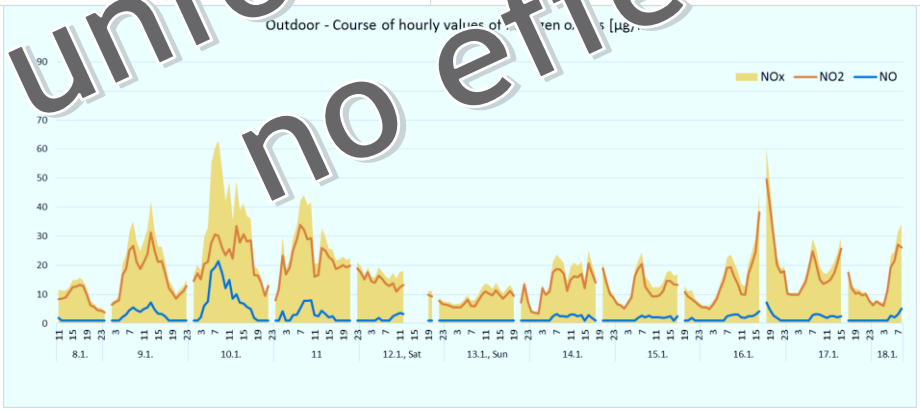
VERIFICATION OF THE IMPACT OF POSSIBLE MEASURES

14 daily comparisons of values in classes with different modes – nitrogen oxides



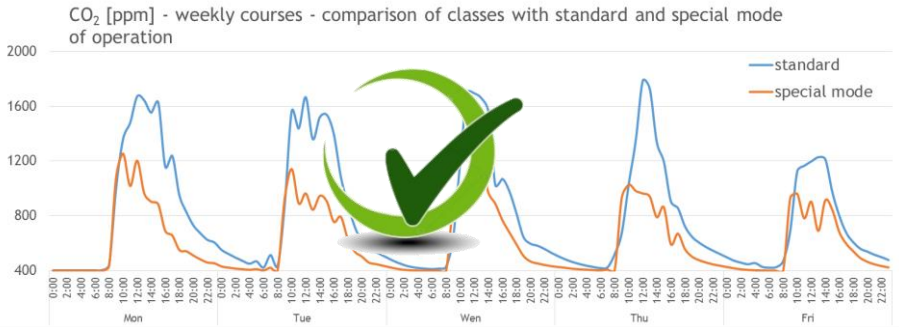


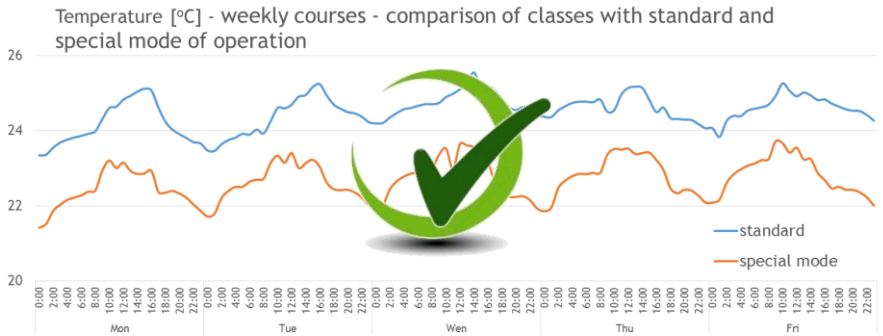
unfortunately, no effect

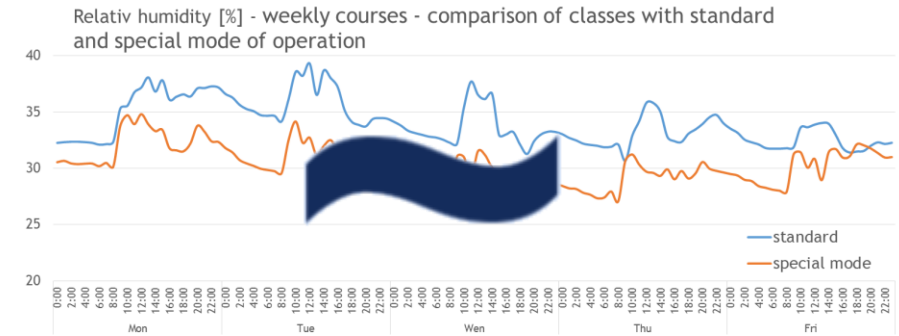


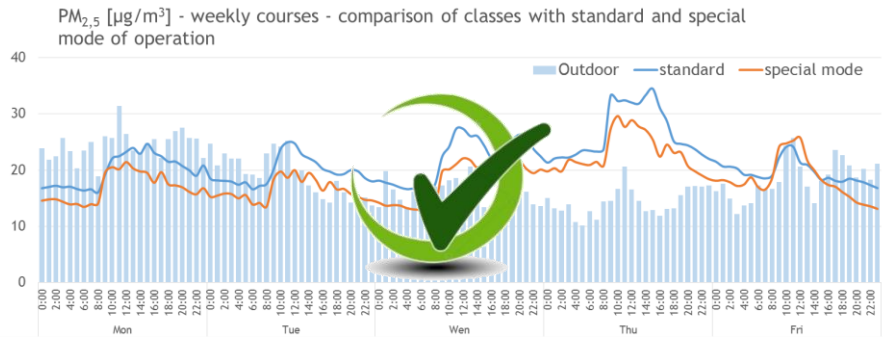
VERIFICATION OF THE IMPACT OF POSSIBLE MEASURES

14 daily comparisons of values of dust, CO_2, temperature and humidity









For CO_2, dust and temperature it ... works, in the case of relative humidity the situation is complicated by the low humidity in the outdoor air

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CONCLUSIONS

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An 80-day air quality measurement was conducted in 12 classes.

In indoor air, application of regime recommendations (cleaning, ventilation) led to a **reduction** of CO_2, $PM_{2.5}$ dust fraction and to optimize room temperature.

No effect was observed for nitrogen oxides.

Conversely, in the case of relative humidity, ventilation through the windows in the classroom during winter **could be** counterproductive.

Outdoor air quality now cannot be influenced.

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THANK YOU

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