

Summary of indicative CO2 measurements in Latvian medical institutions

In 2021, from 7 July to 16 September, the Health Inspectorate (hereinafter - the Inspectorate) performed indicative measurements of indoor air quality indicators in 11 medical institutions, in a total of 80 rooms.

The purpose of the measurements is to identify possible risks in premises where a significant number of persons stay, incl. COVID-19 infected persons and make recommendations for the improvement of indoor air quality.

In Latvia, there is no limit value for CO2 in the indoor air of medical institutions, therefore the value recommended by the World Health Organization (WHO) - 1000 ppm - is most often used as a reference point. The situation is similar with other microclimate indicators. Depending on the physical load of employees, the general requirements for the microclimate are defined in the Cabinet of Ministers Regulation No. of 28 April 2009. 359 "Labor protection requirements at workplaces" in Annex 1.

Taking into account the fact that the spread of Covid-19 and other viruses could increase, Amendments to the Cabinet of Ministers Regulations No. 310 "Regulations on the Latvian construction standard LBN 231-15" Heating and ventilation of residential and public buildings" provides for the minimum air quality indicator in public buildings where a larger number of people gather for a longer period of time. The permissible CO2 level is up to 1000 ppm.

Methods

- The duration of indicative measurements in one room (under normal room operating conditions in the presence of people) is at least 2 (two) astronomical hours with continuous recording of microclimate data.
- Measurements are performed with one DELTA OHM model HD21AB17 and model HD21ABE17 two indoor air quality meters. The device also records temperature, relative humidity, carbon monoxide.
- The measuring devices are placed 1.5 - 2 m above the floor and 1.5 - 2 m away from direct contact with people in the room.
- The measurement location, time, room size, description and other conditions affecting the measurements are recorded in the measurement protocol of the specific room.
- The obtained raw data were processed with a CO2 data analysis program (developer: WHO indoor air quality and safety experts).

Selection of medical institutions

The Inspectorate sent an invitation to volunteer for the project to all Level 4 and 3 hospitals, in total - 14 medical institutions. Consent to participate in the project was received from 9

hospitals. Non-response - 36%. Without an invitation, three medical institutions expressed their wish to participate in the project.

Selection of premises

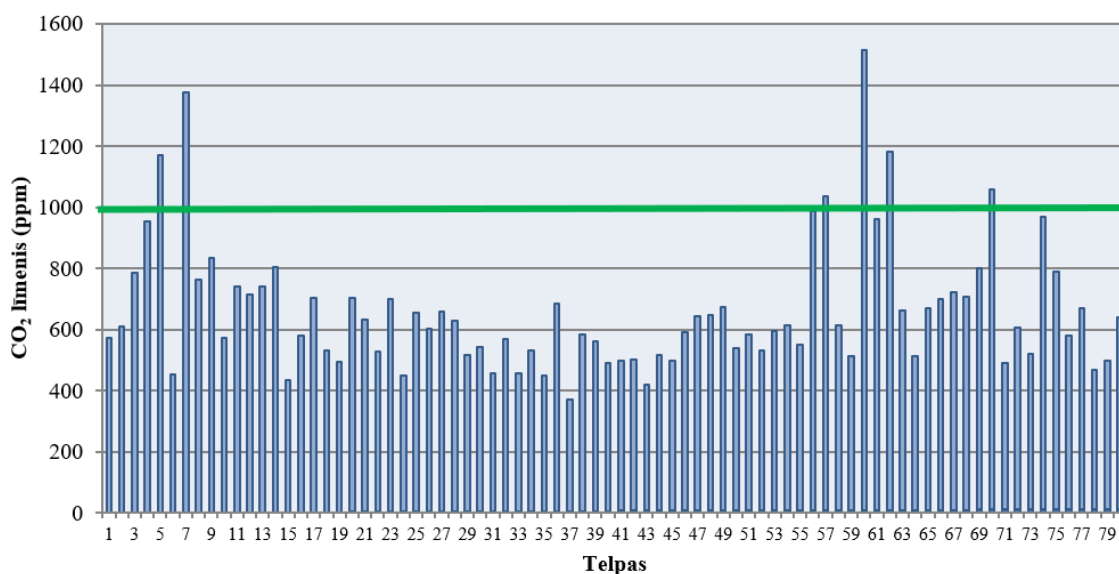
The measurements were to be performed:

- on the premises of the reception department;
- in the premises of the therapy department;
- on the premises of the surgery department.

Practical measurements took place in different types of rooms - patient wards, doctor's offices, procedure rooms, examination rooms, operating theaters, etc., based on the offer, interests and possibilities of the medical institution (if people did not stay in the chosen room during the measurement period, an alternative was sought). In total, 80 premises were surveyed and indicative measurements were performed.

CO2 measurement results

Figure 1. Average CO2 concentration in the premises of medical institutions during indicative indoor air quality measurements (07.07.2021 - 16.09.2021)



The limit of 1000 ppm, taking into account the average CO₂ concentration during the indicative measurements (continuously at least 120 min), was exceeded in 6 (six) rooms, incl. also a level of 1500 ppm in one room.

Table 1. Premises where the CO₂ level exceeds 1000 ppm

N.p.k.	Room (premises)	Average CO ₂ (ppm)	Possible Causes
1	ECG load test room	1171	small space, lots of people, active activities

2	Ultrasonography cabinet	1376	small room, a lot of people, natural ventilation is not possible
3	Reception	1029	intensive flow of people; "Pockets" without air circulation
4	Operating Theatre	1506	intensively used room, outdated ventilation system, natural ventilation is not possible
5	Reception	1172	very intensive flow of people (23 people / 1h)
6	Patient Room	1049	no mechanical ventilation, no possibility of natural ventilation

More than 800 ppm and more than 900 ppm were also achieved in 6 (six) rooms: two patient registration (reception) room, two physicians' rooms, room of physiotherapy, one patient room.

Conclusions

The highest values of the average CO₂ concentration were observed:

- in rooms where denser filling / loading has been found;
- in small rooms where several people were present at the same time;
- in premises where people performed active physical activities;
- in rooms with limited natural ventilation possibilities;
- in rooms with outdated mechanical or natural passive ventilation.

Of all the allocated room types, the greatest risks are due to insufficient air exchange, which can contribute to infection, incl. Covid-19 prevalence, as a result of indicative measurements, was detected in registrars - four cases (50%) of the eight registrars surveyed.

Recommendations

If possible, update the ventilation system used in the institution so that its operation meets the general microclimate requirements of the working conditions of the institution's staff.

To evaluate the possibilities of air cooling and humidification in the staff work and patient care premises in accordance with the outdoor climatic conditions.

To prevent and reduce the risk of the spread of infections in patient care facilities, make sure that the existing ventilation system is working:

- or the direction of air flow - the total air flow in the building and premises is from clean areas to dirty areas;

- whether fresh air is supplied to the room in a sufficiently efficient and effective manner, preventing its potential contamination at each stage of the air flow.

If only natural ventilation is used, it is recommended to increase the intensity of ventilation - to ventilate by opening windows and doors, more often and for a longer period of time, taking into account the outdoor climatic and indoor environmental conditions.

To plan long-term structural improvements to the ventilation system used in the institution, as poor indoor air quality can, among other things, worsen the general health of the institution's patients.

To ensure the microclimate indicator in the premises where there is an intensive flow of people and long-term gatherings, incl. Regular monitoring of CO₂ concentration and regular monitoring of the ventilation system.

To evaluate the cases of intensive operation of small premises (several people for a long time at the same time; physically active activities, etc.) and to find opportunities to use premises with a larger total square footage and volume for the mentioned purposes.

In order to minimize the potential risks of the spread of infections, institutions should use a hybrid (mixed mode) ventilation model for ventilation of the premises - both natural and mechanical ventilation.