Ventilation Recommendations for Public Administration

Introduction

This guide provides practical recommendations for indoor ventilation aimed at improving air quality and occupant wellbeing. Its contents are applicable to different European climate zones and consider aspects of health protection, risk prevention, and energy efficiency. These recommendations are especially relevant to high-occupancy settings such as educational institutions, healthcare facilities, administrative buildings and public housing, which are typically managed by local, regional or national authorities.

Adequate ventilation not only reduces the risk of respiratory diseases but also contributes to a comfortable environment and improved cognitive performance. Furthermore, it responds to the growing need for public bodies to guarantee healthy and sustainable environments in the buildings under their responsibility.

1. Key parameters for public authorities to consider

1.1 Seasonal variations

Ventilation strategies must be adapted to the climatic conditions of each season. This flexibility makes it possible to balance thermal comfort with air renewal and reduced energy consumption. Adapting strategies to each season enables the use of lower temperatures, prevents heat loss during winter, reduces heat gain in summer, and helps to control humidity during periods with a higher risk of mould. This climate-responsive approach ensures more efficient, healthier, and more sustainable ventilation throughout the year, tailored to both regional conditions and the practical use of indoor spaces.

In winter, low outdoor temperatures create a substantial thermal gradient between indoors and outdoors. This leads to the dilemma of maintaining adequate fresh air without excessive heat loss. The traditional practice of keeping windows slightly open continuously is often counterproductive, as it results in substantial energy wastage without effectively controlling humidity or CO_2 levels.

Spring and autumn present transitional challenges with fluctuating temperatures and humidity levels. These seasons often bring increased rainfall and changing conditions that affect ventilation needs. During these periods, the ventilation approach must be flexible and responsive to daily weather changes.

In summer, particularly in Central and Southern Europe, there is a higher risk of overheating in poorly ventilated buildings. The timing of ventilation becomes particularly important to avoid drawing in hot air during peak daytime temperatures.

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Detailed seasonal timings:

Spring: Maximise natural ventilation by opening windows fully for 5–10 minutes, preferably in mid-morning or after rain, to reduce pollen and spore levels. Use cross-ventilation whenever possible. For allergy sufferers, ventilate early in the morning or after rain and consider window filters or air purifiers.

Summer: Ventilate early in the morning and late evening for 10–15 minutes, avoiding 11:00–18:00. Keep windows closed during peak heat. Use shading (blinds, curtains, awnings) and ceiling or standing fans to improve comfort without drawing in hot air. In very hot regions, coordinate ventilation with mechanical cooling systems and consider night ventilation if temperatures drop significantly.

Autumn: Use intermittent ventilation every 2–3 hours by fully opening windows for 5–10 minutes. Begin CO_2 monitoring as buildings become more enclosed. Check that ventilation systems are operational before winter and clean ventilation inlets blocked by leaves.

Winter: Prioritise short, intensive ventilation several times per day with cross-ventilation. Mechanical ventilation systems with heat recovery should be used wherever possible. Maintain indoor humidity between 40–60% and ventilate immediately after cooking or showering. Avoid drying clothes indoors or increase ventilation if unavoidable.

In all seasons, it is generally better to open windows fully for short periods rather than leave them partially open for extended times, as this enables faster and more efficient air exchange. If cross-ventilation is not possible, extend ventilation to 10–15 minutes or ventilate rooms sequentially.

1.2 CO_2 monitoring

Carbon dioxide is a reliable indicator of indoor air quality and ventilation effectiveness. In occupied spaces, CO_2 levels can rise quickly due to human respiration, leading to drowsiness, decreased concentration, and discomfort.

Recommended CO_2 thresholds:

- <800 ppm: excellent air quality.
- 800–1,000 ppm: acceptable, ventilation should be increased.
- 1,000–1,400 ppm: immediate ventilation required.
- 1,400 ppm: urgent ventilation and system evaluation.

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Research has shown that cognitive performance can decline by around 15% when CO_2 levels reach 1,000 ppm and by up to 50% when approaching 1,400 ppm. For this reason, continuous monitoring is strongly recommended. Visual signalling systems (e.g., CO_2 traffic lights such as the MICA Lite device) can help staff respond promptly. CO_2 sensors should be installed in high-occupancy spaces like classrooms, meeting rooms and offices, and linked to maintenance plans to track air quality.

1.3 Mould prevention

Mould development is a significant problem in many European climates, particularly in humid and cold regions. The main causes include relative humidity above 60%, insufficient ventilation, and poor insulation. The combination of winter heating and lack of ventilation creates conditions favourable to mould.

Health risks include allergies, asthma, respiratory irritation, and other problems. Mould also damages building materials, leading to costly repairs.

Areas with the highest risk include exterior corners of rooms, around old window frames with poor insulation, bathrooms, kitchens, basements, below-ground spaces, and behind furniture placed against exterior walls.

Authorities should ensure:

- Constant ventilation through natural (windows) or mechanical means (extractor fans).
- Relative humidity kept below 60%.
- Prompt identification and repair of leaks, cracks and thermal bridges.
- Use of dehumidifiers in high-humidity areas such as basements or poorly ventilated rooms.
- Maintenance of indoor temperature between 18–22 °C.

For existing mould:

- Identify and eliminate the moisture source first.
- Clean small patches (<1m²) with water and detergent or a vinegar solution.
- Consult professionals for extensive or recurring problems.
- Replace affected porous materials such as plasterboard or carpets.
- Improve long-term ventilation to prevent recurrence.

1.4 Economic and energy considerations

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Proper ventilation planning has a direct impact on energy use and costs. Heating and cooling can account for 30–50% of energy consumption in residential buildings. Rising energy prices in Europe and stricter regulations require balanced solutions that combine fresh air supply with energy conservation.

Comparison of ventilation systems:

System	Approx. Cost	Savings	Payback
Controlled natural ventilation	Low	5–10%	1–2 years
Basic mechanical ventilation	Medium	10–20%	3–5 years
Heat recovery systems	High	30–50%	5–8 years
Smart hybrid systems	Very High	40–60%	6–10 years

Ventilation strategies should also be adapted to building type:

- Single-family homes in cold regions: mechanical systems with heat recovery.
- Apartment buildings: centralised systems with individual control.
- Historic buildings: micro-ventilation solutions preserving architecture.
- Office buildings: intelligent systems with occupancy and CO_2 sensors.

When evaluating systems, consider regional energy prices, climate conditions, and available incentives. Cost-benefit analysis should include indirect benefits such as health improvements and higher property value.

2. Seasonal recommendations

Below is a summary of practical recommendations applicable to public buildings:

Spring:

- Ventilate fully for 5–10 minutes, preferably mid-morning or after rain.
- Monitor humidity and pollen levels.
- Use window filters if needed.

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Summer:

- Ventilate early morning and late evening.
- Keep windows closed during the hottest hours.
- Use shading and fans to improve comfort.

Autumn:

- Intermittent ventilation every 2–3 hours.
- Check systems before winter.
- Control condensation.

Winter:

- Short, intensive ventilation several times per day.
- Use mechanical ventilation with heat recovery.
- Maintain indoor humidity between 40–60%.

3. CO_2 management strategies

For intensively used public buildings, it is recommended to:

- Set a maximum threshold of 800 ppm for good air quality.
- Install visual warning systems (CO_2 traffic lights).
- Integrate CO_2 monitoring into building maintenance plans.
- Train staff to interpret readings and take action.
- Combine natural and mechanical ventilation for optimal results.

4. Specific measures for mould prevention

Authorities should ensure:

- Constant ventilation, natural or mechanical.
- Humidity below 60%.
- Timely repair of leaks and thermal bridges.
- Regular inspection of high-risk areas.
- Clear cleaning protocols and professional interventions if needed.

5. Economic and effi ciency criteria

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Public administrations should lead by example through:

- Prioritising heat recovery systems.
- Combining passive strategies (cross-ventilation) with active technologies (sensors, automation).
- Using funding incentives.
- Performing thorough cost-benefit analyses including health and productivity gains.

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