Developments in Internation... Ventilation Standards

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Organisations

The International Standards Organisation (ISO) is a federation of national standards bodies comprising ninety countries. The objective is to promote the development of standardisation and related activities with a view to facilitating international exchange. The organisation involves producers, users, consumers, scientists and engineers. Current and planned standards cover air permeability, air leakage testing and indoor air quality.

The World Health Organisation tackles health related issues by forming an hoc groups of international experts to address particular topics. Air quality guidelines for Europe are based on the best medical knowledge to date and which is used to review the maximum threshold values for exposure to a limited number of pollutants. These values are based on

1. Carcinogenic risk.
2. Toxicity levels
3. Odour and comfort
4. Ecological effects

The European Committee for the Normalisation of Standards (CEN) prepares standards specifically in a European context. CEN often adopts ISO Standards.

Within the European Union ventilation Standards are being developed by Task Group ISG 156, described more fully in the previous paper.

In 1992 the European union introduced the 'CEC European concerted action programme in air quality and its impact on man' to provide guidelines on ventilation and air quality in buildings. This guide introduced the concept that odours could come from the building components and services as well as from body odours and cigarette smoke. The World Health Organisation's guidelines were supported and reproduced as an Appendix.

The health aspects of indoor pollution were emphasised. These included

1. Radon gas, usually from ground leakage from radioactive rock strata underneath the building.
2. Landfill gases such as methane which develops from rotting material dumped in landfill.
3. Environmental tobacco smoke, particularly to the non smoking 'passive' smoker in the room.
4. Formaldehyde gas leaking from adhesives or insulants within the building or furniture structure.
5. Volatile organic compounds from solvents, polishes and adhesives.
6. Metabolic gases from humans.
7. Humidity and the ability of mould spores to develop and germinate in profusion at high humidities.
8. Microorganisms which can thrive indoors.

The perceived air quality aspects considered the odour pollution from all sources and therefore treats the building furnishings and fabric as pollution sources as well as the occupants. This was achieved by introducing the olf as the strength of odour source equivalent to that of an adult and the decipol as the odour intensity equivalent to that when diluting the body odour of an adult (an olf) with a clean air supply of 10 l/s/p.

Some European countries have adopted aspects of the CEC Guidelines.

The five Nordic countries of Denmark, Finland, Iceland, Norway and Sweden each have Building Regulations of their own with the Nordic Committee on Building Regulations representing the coordinating agency. The Nordic Committee has an Indoor Climate Air Quality Committee "to safeguard the health and safety of citizens, to safeguard a good environment and to achieve economical energy management". This Committee considers nine actions regarding the air quality

1. Planning, which involves site location, the outdoor environment , the presence of radon etc.

2. Design, which includes the extent of polluting material within the building and the cleanability of materials.

3. Requirements for ventilation, which in part adopts the European Guidelines.

4. Documentation for the operator.

5. Management of the air quality.

6. Operation of the equipment in a satisfactory manner.

7. Maintenance of the equipment to maintain the air quality.

8. Quality assurance of the air quality.

9. Inspection to check that designed procedures are followed.

This has resulted in Regulations for the Nordic countries which include fundamental design principles

1. Controls shall be easy to reach.
2. Components must be accessible.
3. The system must be cleanable.
4. The components must be durable.
5. Installations must have the required air tightness.
6. Ventilation performance must be demonstrated.
7. All information must be documented.

These Nordic Regulations are supported by SCANVAC which is the joint coordinating body for the professional institutions practising building services engineering within these countries. Corresponding societies in the Baltic states of Estonia, Latvia and Lithuania are associated members. SCANVAC helps to translate the Nordic Regulations into practice.

Mechanical ventilation designs can only be successful if the unplanned infiltration is small in comparison. This requires a standard for air tightness and many countries have evolved an appropriate air tightness specification which depends upon the ventilation system, much higher air tightnesses being specified when the buildings are designed for balanced ventilation systems. Air leakage is assessed in terms of air changes per hour (ACH) when the building is pressured to 50 Pascals. Various standards also cover the air tightness, durability and performance of the components used in the building construction (e.g. the performance of windows, doors, sealants and sealing components.

Some countries specify minimum ventilation requirements for dwellings. Scandinavia, the Netherlands and France specify stack ventilation if mechanical ventilation is not installed. Sweden requires mechanical ventilation with heat recovery when the space heating energy reqirements exceed 2 MWh/year and Canadian regulations require less than 5 Pascals under pressure in buildings with unforced combustion stacks.

Sweden is unusual in requiring compulsory system checks under the Swedish Work Environment Act and the Swedish Planning and Building Act. The inspection interval varies from 9 years for single family homes with balanced ventilation to every two years for day centres, schools and health care premises.

Factors influencing air quality

The means of securing optimum indoor air quality depends upon control of the polluting source, the ventilation system itself and the designed performance of the ventilation system within the building envelope.

Clean outdoor air is essential for achieving good indoor air quality. Although air cleaning is possible, it is costly and not effective in the many offices and dwellings that are either naturally ventilated, leaky or are ventilated by mechanical extract systems.

Pollutants emitted inside buildings are derived from metabolism, the activities of occupants and emissions from equipment, furnishings and building materials.

Achieving optimum indoor air quality relies on an integrated approach to the removal and control of pollutants based on source control, filtration, enclosing pollutant sources and ventilating the occupied space. All these mechanisms are governed by Standards, Codes of Practice and Regulations.

To fulfill the needs of best practice, it is important that these requirements and recommendations are followed. Comprehensive ventilation, health and indoor air quality guidance is regularly produced and updated as part of ASHRAE Standard 62 in the United States. Within the European Union, ventilation related Standards are being developed by Task Group 156, while in Scandinavia, the Nordic Committee on Building Regulations has published comprehensive ventilation guidelines.

Requirements are often "prescriptive" in the sense that the minimum rate of ventilation or the minimum size of ventilation openings is specified. Air flow rates are typically indicated for different types of room, occupant density or activity. Additional "air quality" requirements relate the amount of extra ventilation needed to deal with individual contaminant sources that may be present. Sometimes a choice may be given to select either a "prescriptive" or an "air quality" approach to estimating ventilation need. In general there is a strong linkage between Standards covering the requirements for ventilation and those associated with other aspects of energy efficiency and comfort within buildings. Adherence to this linkage is vital for securing reliable ventilation.

Linked topics include:
Health: Health related air quality Standards are typically based on risk assessment and are either specified in terms of a maximum permitted concentration or a maximum permitted dose. Higher concentrations of pollutants are normally permitted for short term exposure than are permitted for long term exposure. Typical examples include 1-hour and 8-hour "threshold Limit Values" or TLV's. Requirements cover the minimum ventilation needed to avoid injury to health. Values are largely prescribed according to building type, nature of pollutants, emission rates and acceptable exposure levels.

Energy Efficiency: Standards cover the avoidance of excessive energy waste. In some cases there may be a requirement for ventilation heat recovery.

Comfort: Air quality needs for comfort are highly subjective and dependent on circumstances. In the industrial arena, for example, higher levels of odour and heat may be tolerated than would be acceptable in the office or home. As a rule, health related air quality Standards, such as TLV's, set the minimum requirements for safety; these may not necessarily provide for comfort or efficiency at work or in the home. Requirements or recommendations may cover thermal comfort and odour intensity and the absence of draughts.

Ventilation Strategies: Standards often cover the type of ventilation appropriate to specific applications (e.g. enclosing polluting processes, extracting from kitchens and bathrooms, provision of fresh air supply to occupied spaces and the sizing of ventilation systems).

Air tightness: Energy efficient ventilation performance can be destroyed if the air-tightness of the structure is not compatible with ventilation strategy. Several countries have now introduced standards or recommendations covering the air-tightness performance of buildings. Similarly, various Standards cover the air-tightness durability and performance of the components used in building construction (e.g. the performance windows, doors, sealants and sealing components).

Conclusions
- Ventilation is just one component of the "Air Quality" process. Standards must consider related issues.
- An understanding is being reached on how ventilation performance is coupled to other fields.
- There is a good collaboration between Countries through CEN, ASHRAE, ISO and other groups.
- The Standards of some Countries, especially in relation to systems and air-tightness is more advanced than the UK.
- Information on Standards is regularly updated by the AIVC and is published in the AIVC Technical Note 43 "Ventilation and Building Airtightness: an International Comparison of Standards, Codes of Practice and Regulations".