

A325

Research Report Review

# Minimum ventilation rate

## New report from small country makes news in permissible ventilation rates

**D. Fitzgerald, Ph.D.***Member ASHRAE*

**I**F YOU HAVE BEEN a member of ASHRAE for a few years, you will have a complete set of the ASHRAE Handbooks; the most recent is the 'Systems' volume of 1984, and the oldest next to be replaced is the 'Fundamentals' volume. If you want guidance from ASHRAE on how much ventilation ought to be provided, you look in Chapter 22 of the 'Fundamentals' volume and there you will find the information, together with references to the original work by Yaglou on which much of the information is based. If you look up the references, you will be surprised - to use no stronger word - that the work is now nearly 50 years old. Some 15 years ago, the present writer was a research worker in what was then known as the Heating and Ventilating Research Association, an industrial co-operative of our industry in the United Kingdom. In those days and today, the same ventilation information is used in the U.K., and the Director of the Research Association, Mr. Neville Billington OBE MSc, wanted new observations to be made to replace the excellent work by Yaglou, then some 35 years old. Lack of funds prevented the work.

The purpose of the present article is to report that new work on permissible minimum ventilation rates has been reported from an even smaller European country, the Netherlands.

The Steering Group 'Energy and Buildings' of the Dutch Ministry of Housing assigned the task of determining permissible minimum ventilation rates in offices to the Research Institute for Environmental Hygiene of the Central Organization for Applied Scientific Research TNO in the Netherlands.

The author of the report is Dr. H.B. Bouwman. A foreword by Professor Fanger of the Technical University of

Denmark is followed by a page of 'Summary and Conclusions,' Notes to Readers, etc., and then a very unusual feature: before the hundred or so pages of the actual report there are 11 pages entitled 'Abridged Report,' much more than the excellent summary, and enough to give a reader pressed for time a clear view of what was done, and the results, including several figures which repay careful study.

In addition to the fact that the ventilation data used in the U.S. and the U.K. are now about half a century old, there have been great changes in the way we live. We surround ourselves with materials which did not exist 50 years ago, and which we know give off gases and vapours, such as upholstery plastics, carpet underlays which are not fibrous, hardboard and other modern sheet material and the like. In addition, we have become aware of the continuous emission of radon, the radioactive gas, by building materials originating from the ground, and the ground itself.

As we decrease ventilation rates to reduce ventilation losses, so the concentrations of all these gases and vapours increase, having an unknown effect upon us, apart from some of them having a nasty smell.

The purpose of the work being reported was only concerned with those offensive smells which might come from any of these sources, including what is described as 'cosmetics, particular food choices, limited personal hygiene, over-tiredness, illness, etc.' The numerical purpose of the work was to find the rate of ventilation required to keep complaints "that the smell is no longer acceptable" from occupants of rooms to less than 5 percent or 1 percent. Which of these levels should be used is of course a matter for discussion with the occupants and 'experts on the indoor environment,' whoever they are.

The results obtained were 35 and 50 m<sup>3</sup>/h per person for less than 5 percent and 1 percent of complaints (21 and 29 cfm). It follows that reducing ven-

### Research report translation available

Copies of *Minimum Ventilation Rates — A Research Report*, which is reviewed in this article, are available through ASHRAE. There are a limited number of English translation copies of the Dutch report on hand. The price is \$45 for members and non-members.

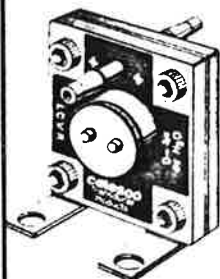
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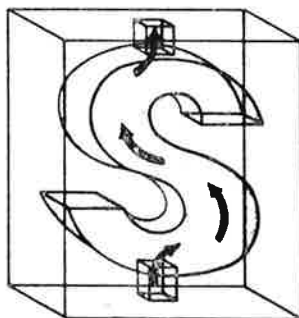


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tilation to 25  $m^3/h$  per person (15 cfm) in order to save energy is not justifiable, in view of the increasing number of complaints to be expected.

How was the work done? Tests were done in offices, some only with men, others with men and women working together. Smoking was sometimes allowed. Curiously, a 'non-smoker' was defined, for the purposes of the work, as someone who smokes no more than one cigarette per day.

The 'odour concentration' was determined using a vehicle connected to the test room by a duct, to collect air for presenting to the eight test staff in the 'sniff car.' These testers are presented with three cups to smell, one offering air from the room, and the two others offering this air diluted, and fresh air. The testers do not know which cup is which, and from their answers, with an elementary computer program, it is possible to determine the amount of dilution needed to ensure that half the observers can no longer distinguish the diluted air from fresh air. The factor of dilution, usually greater than unity, is defined as 'odour concentration.' This will be about 10 if there is no smoking and moderate ventilation, rising to 100 if there is considerable smoking. Near 'stink producing' industry, out of doors, concentration of 10 to 100 or even 1,000 may be found.

This report is important reading for anyone concerned with ventilation, its provision in the course of design, or its study in research. The results of the work might find their way onto the agenda of Technical Committee 4.3, concerned with ventilation requirements and infiltration, so that the work may be studied by specialists, and if their view agrees with that of your review, the results of the work will find their way into the next edition of the 'Fundamentals' volume of our Handbook. ■

## About the author



D. Fitzgerald, Ph. D. is a Senior Lecturer in Architectural Engineering in the Department of Civil Engineering of the University of Leeds. He previously worked in the Coal Research Laboratory of the National Coal Board of the United Kingdom. He graduated from the University of Cambridge and received his Ph. D. from the University of London. His research is mostly concerned with passive solar energy. He has had several contracts in this field with the European Economic Community.