Second Hand Smoke in Bars and Restaurants

A second opinion on possibilities to reduce exposure to second hand smoke in bars and restaurants to safe levels

November 2009

Foreword

The Ministry of Health of the Netherlands has indicated that it seeks answers to the following questions:

1. Are there standards with which the amount of second-hand smoke or maximum levels that can be found in the smoke-free rooms could be compared? Which indicator substances should be considered?
2. How can maximum levels of SHS be monitored in practice?
3. Are other options than separate smoking rooms currently available, guaranteeing that in practice the amount of SHS remains below certain maximum levels?
4. Could a certification system guarantee that alternative measures are equally effective in practice as separate smoking rooms regarding practical application, enforcement and health protection? Or is there a need to complement certification with actual measurements?

After an initial response was received from the National Institute of Public Health and the Environment, an international expert committee was convened to provide a second opinion about these questions, consisting of

- Prof. Bert Brunekreef, Professor of Environmental Epidemiology, Director of the Institute for Risk Assessment Sciences, University of Utrecht, the Netherlands (chairman)
- Prof. Jon Ayres, Professor of Environmental and Respiratory Medicine and Director of the Institute of Occupational & Environmental Medicine at the University of Birmingham, UK
- Prof. Torben Sigsgaard, Professor of Occupational Medicine, Head of the Department of Environmental and Occupational Medicine and Deputy Director of the Institute of Public Health at Aarhus University, Denmark
- Prof. William Nazaroff, Daniel M. Tellep Distinguished Professor, Vice-Chair for Academic Affairs, Civil & Environmental Engineering Department, University of California, Berkeley, USA
- Prof. Johan de Jongste, Professor of Pediatric Respiratory Medicine Department of Pediatrics, Erasmus University Medical Center - Sophia Children's Hospital, Rotterdam, the Netherlands.

The committee was assisted in its work by Roel Bennink, Quality Assurance Netherlands Universities (QANU), who acted as secretary.

The committee met through e-mail, telephone and a meeting on November 2 in Utrecht with profs Sigsgaard and Brunekreef which was attended by all other committee members by telephone. The committee based its judgement on recent authoritative documents and reviews, and on pertinent references to individual studies from the peer reviewed literature. The Abstract contains the short answers to the questions. The body of the report provides an international perspective as an introduction, and rationales for the short answers to the four questions posed by the Ministry of Health.

Utrecht, November 2009

Summary

Smoking has been banned from bars and restaurants in the Netherlands since July 1, 2008. However, owners of large bars and restaurants have been allowed to create smoking rooms. Also, due to ambiguities in the law, enforcement of the smoking ban for small bars without employees has been temporarily suspended. The question has arisen to what extent smoke escapes from the smoking rooms into the non-smoking sections of the venues where they have been created, and to what extent ventilation and filtration provisions could sufficiently reduce levels of second hand smoke in venues where smoking still occurs. Four questions were developed by the Ministry of Health, for which an international expert committee was asked to provide answers. The committee answered the four questions as follows:

1. *Are there standards with which the amount of second-hand smoke or maximum levels that can be found in the smoke-free rooms could be compared? Which indicator substances should be considered?*

Answer
There are no *standards* with which the amount of second hand smoke (SHS) or maximum levels that can be found in smoke-free rooms can be compared. This is because second hand smoke causes cancer and other adverse effects on health, and no safe levels of exposure exist other than absence.

SHS is a complex mixture of many different components, but there are a few *indicator components* that have been used frequently to characterize the SHS concentration in indoor spaces. These include airborne fine particle matter (FPM) and airborne nicotine.

2. *How can maximum levels of SHS be monitored in practice?*

Answer
SHS levels have been measured in various ways, but most frequently by measuring concentrations of airborne fine particulate matter, or airborne nicotine. To measure *maximum* levels when smoking occurs, direct reading instruments to measure FPM or particle number counts have been used mostly. Using appropriate air sampling techniques, nicotine concentrations can be measured over short averaging time (down to about 30 minutes) but this requires laboratory analysis of collected samples.

3. *Are other options than separate smoking rooms currently available, guaranteeing that in practice the amount of SHS remains below certain maximum levels?*

Answer
As no maximum levels of SHS other than absence can be defended on health grounds, there are no options other than smoking bans to guarantee that SHS concentrations remain below acceptable maximum levels. The available evidence shows that in rooms where smoking is allowed, it is impractical to achieve sufficiently low SHS concentrations from a health point of view.

4. *Could a certification system guarantee that alternative measures are equally effective in practice as separate smoking rooms regarding practical application, enforcement and health protection? Or is there a need to complement certification with actual measurements?*

Answer

As sufficiently low SHS concentrations cannot practically be achieved through technical means in rooms where smoking is allowed, there is no need to consider the distinction between certification and certification plus measurements for such means.

Samenvatting: Omgevingstabaksrook in de Horeca

Samenvatting van het advies van een internationale commissie van deskundigen
November 2009

Sinds 1 juli 2008 is het wettelijk verboden te roken in horeca gelegenheden. Het is eigenaren echter toegestaan binnen hun bedrijf aparte rookruimtes in te richten. Vanwege juridische problemen is de uitvoering van de wet voor kleine horeca gelegenheden zonder personeel tijdelijk opgeschort. De vraag is gerezen in hoeverre rook vanuit de aparte rookruimtes doordringt in het rookvrije gedeelte van de gelegenheden waarin zij zijn aangebracht. Ook is de vraag gesteld in hoeverre ventilatie- en filter installaties de blootstelling aan tabaksrook voldoende zouden kunnen verminderen in gelegenheden waar het roken nu wordt gedoogd. Het Ministerie van VWS heeft vier vragen voorgelegd aan een internationale commissie van experts. Vragen en antwoorden worden hieronder vermeld. Een gedetailleerde motivatie van de antwoorden is te vinden in het Engelstalig rapport van de commissie.

Vraag 1: zijn er normen waarmee de hoeveelheid omgevingstabaksrook ('second hand smoke'), dan wel de maximale concentraties die in rookvrije gedeeltes worden waargenomen, kunnen worden vergeleken? Welke indicatorstoffen kunnen worden overwogen?

Antwoord: Er zijn geen normen waarmee de hoeveelheid omgevingstabaksrook ('second hand smoke'), dan wel de maximale concentraties die in rookvrije gedeeltes worden waargenomen, kunnen worden vergeleken. De reden is dat omgevingstabaksrook kankerverwekkend is, en ook andere gezondheidsschade veroorzaakt, en er is geen veilig niveau van blootstelling.
Omgevingstabaksrook is een complex mengsel van veel verschillende stoffen, maar er zijn wel enkele indicatorstoffen die vaak zijn gebruikt om de hoeveelheid omgevingstabaksrook in de binnenlucht vast te stellen. Het gaat daarbij met name om fijn stof en om nicotine in de lucht.

Vraag 2: Hoe kunnen maximum niveaus van omgevingstabaksrook in de praktijk worden gemeten?

Antwoord: Omgevingstabaksrook wordt in de praktijk meestal gekarakteriseerd door het meten van fijn stof, of nicotine in de lucht. Voor het meten van maximum niveaus zijn gewoonlijk instrumenten gebruikt die de fijn stof massa, of het aantal stofdeeltjes in de lucht van minuut tot minuut bepalen. Met de juiste luchtbemonsteringstechnieken kan de nicotineconcentratie over periodes van een half uur of langer worden bepaald, maar hiervoor is analyse van de verzamelde monsters in het laboratorium noodzakelijk.

Vraag 3: Zijn er andere opties dan het inrichten van aparte rookruimtes die garanderen dat de concentratie omgevingstabaksrook beneden een bepaald maximum niveau blijft?

Antwoord: Aangezien er geen gezondheidkundig verantwoord maximum concentratie omgevingstabaksrook anders dan afwezigheid kan worden vastgesteld, zijn er geen andere opties dan een rookverbod om ervoor te zorgen dat de concentratie omgevingstabaksrook voldoende laag blijft. De beschikbare wetenschappelijke gegevens laten zien dat in ruimtes waar roken is toegestaan, het praktisch onmogelijk is om uit oogpunt van gezondheid aanvaardbaar lage concentraties omgevingstabaksrook te bewerkstelligen.

Vraag 4: Kan een systeem van certificering garanderen dat alternatieve maatregelen in de praktijk even effectief zijn als het inrichten van aparte rookruimtes in termen van praktische toepasbaarheid, naleving en gezondheidsbescherming? Of is het nodig om een systeem van certificering aan te vullen met metingen in de praktijk?

Antwoord: Omdat het in de praktijk niet mogelijk is met technische maatregelen voldoende lage concentraties omgevingstabaksrook te bewerkstelligen in ruimtes waar roken is toegestaan, is het niet nodig in te gaan op het onderscheid tussen certificering van installaties, en certificering plus metingen in de praktijk.

Tobacco smoke and ventilation of indoor spaces

More than 25 years ago, experimental studies already showed that, even at high ventilation rates, airborne particulate matter concentrations indoors are clearly increased to levels considered unacceptable when smoking occurs (1). Since then, many studies have addressed the health hazards of exposure to second hand smoke (SHS) indoors, and explored possibilities to reduce exposure to SHS by various means ranging from complete smoking bans, to technical interventions, to designation of smoking and non-smoking sections in buildings. Such studies have been reviewed multiple times, by authoritative bodies such as the World Health Organisation (2), the Dutch Health Council (3), the US Surgeon General (4), The American Society of Heating, Refrigerating and Air-conditioning Engineers (5), a coalition of major public health organisations and institutes in Europe (6), etc. In 2004, the International Agency of Research on Cancer concluded that involuntary smoking (exposure to second hand or 'environmental' tobacco smoke) is *carcinogenic to humans (Group 1)* (7). All of these bodies have concluded that there is no safe level of exposure to SHS, and that smoking best be eliminated from the indoor environment. Most recently, an expert panel convened by the US National Academy of Sciences has reviewed the relationship between SHS and acute coronary events (8). The committee came to several conclusions, including (1) that it is biologically plausible for a relatively brief exposure to secondhand smoke to precipitate an acute coronary event, and (2) that there is sufficient evidence to infer a causal relationship between indoor smoking bans and a decreased risk of acute myocardial infarction. This report, by emphasizing the potential of even brief periods of SHS exposure to produce acute and life threatening coronary events, gives a special sense of urgency to eliminate SHS exposure in so far as possible. This may especially apply to susceptible subpopulations such as cardiac patients.

ASHRAE (5), the European Smoke Free Partnership (6) and the Surgeon General's report (4) have explicitly addressed the question whether ventilation and/or filtration of indoor air can reduce exposure to SHS sufficiently; all conclude that this is not so, and that it would be unwise to stimulate building owners to invest in smoking rooms, and/or costly ventilation and/or filtration equipment. The Federation of European Heating and Air-conditioning Associations (REHVA) has published a guidebook on ventilation and smoking (9). Whereas REHVA in 2004 did not conclude that SHS levels could not be controlled by ventilation and/or filtration, the case studies presented in the guidebook without exception show that such provisions fail to eliminate exposure to SHS by a fairly wide margin.

Many constituencies have moved to implement complete or partial smoking bans in workplaces and public buildings, often after lengthy opposition from especially the hospitality sector. Two recent authoritative reviews suggest that such smoking bans not only reduce exposure to SHS to very low levels, but are also associated with significant reductions in the incidence of myocardial infarctions (MI) in the population (8, 10-13). These reductions in MI incidence are not restricted to non-smokers, but apply to ex smokers and smokers as well, suggesting that even for active smokers, exposure to SHS increases the risks of acute myocardial infarction. Smoking bans implemented in Norway (14, 15), Sweden (16), Scotland (17), Spain (18), the United States (19) and Ireland (20) have all documented improvements in respiratory health parameters among nonsmoking and also smoking employees. One study compared results between venues allowing smoking in designated areas and venues with complete bans, and found less of an improvement in respiratory health in the former compared to the latter (18).

In some areas where smoking bans in the hospitality sector have been implemented for many years now, research has revealed critical factors that determine success or failure of such regulations in terms of compliance by owners of bars and other hospitality venues. One such study was conducted in California where a smoking ban has been in place since 1998 (21). The conclusions were that the following conditions facilitated bar owners' compliance with a smoking ban in bars: if the cost to comply was minimal; if the bars with which they were in competition were in compliance with the smoking ban; and if there was authoritative, consistent, coordinated, and uniform enforcement. Conversely, the conditions that hindered compliance were: if the law had minimal sanctions; if competing bars in the area allowed smoking; and if enforcement was delayed or inadequate.

Answers to the questions

1. *Are there standards with which the amount of second-hand smoke or maximum levels that can be found in the smoke-free rooms could be compared? Which indicator substances should be considered?*

Answer

There are no *standards* with which the amount of second hand smoke (SHS) or maximum levels that can be found in smoke-free rooms can be compared. This is because second hand smoke causes cancer and other adverse effects on health, and no safe levels of exposure exist other than absence.

SHS is a complex mixture of many different components, but there are a few *indicator components* that have been used frequently to characterize the SHS concentration in indoor spaces. These include airborne fine particle matter (FPM) and airborne nicotine.

Rationale

SHS is a human carcinogen, and no safe levels or exposure are thought to exist. SHS also contributes to acute and chronic manifestations of cardiovascular disease, with a public health burden that is much greater than the burden associated with its carcinogenic effects (4). Because of its carcinogenicity and the associated impossibility to identify safe levels of exposure to SHS, standards for the indoor concentration of SHS have not been set. In the more distant past, standards for airborne nicotine have sometimes been proposed (22) but this has never been taken up by major regulatory bodies in the world. When such standards were proposed, they were very low, in the order of less than 10 nanograms of nicotine per cubic meter of air. Such a level cannot practically be achieved in indoor spaces where smoking is allowed. Another analysis estimated the cancer risk from residential exposure to SHS, from established risk factors for five known or probable human carcinogens present in SHS (23). The lifetime risk was calculated to range from 100 – 1,000 per million, based on exposure to 14-20 cigarettes smoked per day in the residence and realistic assumptions of ventilation rates and house volumes. As this analysis is based on five substances only, and SHS is known to contain many more carcinogens, this result is likely an underestimate. A negligible cancer risk level of 1 per million is often used in public health practice, and these calculations suggest that such risk levels can only be achieved at near zero smoking levels.

There is sufficient evidence for a causal relationship between SHS exposure and cardiovascular disease and mortality among men as well as women (4). Because of the high incidence of heart disease in the population, compared to the incidence of lung cancer, the public health burden from heart disease and deaths caused by SHS exposure in the population is much larger – more than 10-fold (4) - than the burden attributable to lung cancer deaths from SHS. Recent evidence is documenting the potential for even brief periods of SHS exposure – as they are encountered by visitors of hospitality venues where smoking occurs - to precipitate acute and life threatening coronary events (8, 10-13). Smoking bans have now shown immediate benefits in reducing the incidence of acute coronary events in the population, adding another argument to eliminate SHS from indoor spaces accessible to the public.

Of the indicators used for measuring SHS in indoor air, airborne fine particulate matter (FPM) and airborne nicotine have been used most frequently. Smoking in indoor spaces increases the concentration of FPM to levels that may exceed 1,000 $\mu g/m^3$ under realistic circumstances (24). Such levels are rarely if ever encountered in non-industrial workplaces or public buildings where smoking is not allowed. Typically, FPM levels are in the order of a few tens of $\mu g/m^3$ at most. However, FPM has other sources as well, indoors

(e.g. from cooking meals) as well as outdoors, and at low levels of smoking and high ventilation rates the FPM concentration is not sufficiently specific to characterize exposure to SHS.

Airborne nicotine is a highly specific indicator for SHS, and this component has been frequently measured, e.g. (16, 25, 26). Whereas airborne nicotine levels in non-smoking spaces are typically in the order of 0.01 - < 0.1 $\mu g/m^3$, levels may exceed 100 $\mu g/m^3$ in hospitality venues where smoking is allowed, a 1,000 to 10,000 fold increase.

2. *How can maximum levels of SHS be monitored in practice?*

Answer

SHS levels have been measured in various ways, but most frequently by measuring concentrations of airborne fine particulate matter, or airborne nicotine. To measure *maximum* levels when smoking occurs, direct reading instruments to measure FPM or particle number counts have been used mostly. Using appropriate air sampling techniques, nicotine concentrations can be measured over short averaging time (down to about 30 minutes) but this requires laboratory analysis of collected samples.

Rationale

SHS is a mixture of chemical compounds in both the gas and condensed phases. The relative proportions of the constituents can vary with circumstances owing to the dependence of emission rates on combustion conditions and differences in the dynamic behaviours of the constituents in indoor environments (27). There are no techniques for measuring whole ETS. Instead, one measures indicators (28). The most frequently measured variables are airborne fine particulate mass (FPM) and airborne nicotine (29).

Techniques exist which allow real-time measurements of particulate matter in the air, and such methods have been used to document that in indoor spaces where smoking takes place, very high levels of airborne fine particle mass (FPM) are attained, e.g. (24). FPM matter has other sources besides smoking, however, and at low levels of smoking and high ventilation rates, measurement of FPM is less specific and may be confounded by these other sources including outdoor pollution.

Nicotine is specific to tobacco smoke, and many investigators have measured nicotine in indoor spaces (homes, offices, bars, restaurants etc.) to document the effects of smoking, e.g. (16, 25, 26). However, there are no commercial real-time monitors of nicotine. Typically, nicotine sampling is either based on use of a pump to draw a sample of air through a sorbent for a period ranging from minutes to hours or a diffusive sampler is deployed for days to passively accumulate nicotine. In either case, the chemical analysis to determine the nicotine level sampled is carried out in the laboratory (30). In the absence of smoking, levels of nicotine in indoor air are very low, and detectable levels of nicotine essentially mean that smoking has occurred in or very near to the room where the measurements took place (16, 25, 26).

Nicotine has proven to be a good marker in environments where smoking occurs. Its strong sorptive behaviour, however, undermines its use in situations where smoking is spatially restricted. Consider, for example, a two-room indoor space in which smoking is allowed in one room but does not occur in the other. Allow that some air exchange occurs between the rooms, but that the SHS levels in the smoking room are markedly higher than in the non smoking room. In this case, evidence suggests that nicotine in the non smoking room would systematically underestimate the levels of most other SHS components in the non smoking room. The underlying reason is the strong sorptive uptake of nicotine to surfaces

(31). Related to this is the temporal pattern of SHS species concentrations in relation to temporally variable levels of smoking. The levels of nicotine exhibit more modest time-varying concentrations in response to time-varying emissions than do non sorbing components such as PM or formaldehyde. A third factor is that the sorptive behaviour of nicotine can be influenced by concentrations of other species in air, such as ammonia. These considerations (a) interfere with nicotine's suitability as a SHS marker compound across diverse environmental conditions; and (b) raise concerns about exposures to populations, such as cleaning staff, who might need to work in smoking environments after the SHS has been removed (by ventilation), but when residual sorbed components may desorb from surfaces causing exposures. This pathway is sometimes referred to as third-hand smoke exposure (32).

Other methods that have been devised for measuring indicators of SHS are not as widely used as the measurement of FPM and nicotine. A photoelectric aerosol sensor has been developed for real-time measurement of particle-bound polycyclic aromatic hydrocarbons, for which tobacco smoking is a strong source (33). Sampling of airborne particles and subsequent laboratory analysis of the tobacco-specific chemical solanesol is possible (34) but has similar limitations to the sampling and analysis of nicotine. An alternative marker to nicotine for gas-phase ETS is 3-ethenylpyridine (35).

3. *Are other options than separate smoking rooms currently available, guaranteeing that in practice the amount of SHS remains below certain maximum levels?*

Answer

As no maximum levels of SHS other than absence can be defended on health grounds, there are no options other than smoking bans to guarantee that SHS concentrations remain below acceptable maximum levels. The available evidence shows that in rooms where smoking is allowed, it is impractical to achieve sufficiently low SHS concentrations from a health point of view.

Rationale

Beyond banning smoking indoors, the other potential measures are some combination of ventilation (removal of air containing ETS from the indoor space), air flow control (preventing/limiting transport of ETS to the breathing zone of occupants), and filtration (removing health-harmful constituents of ETS from airstreams). Source control can be practiced through the use of, e.g., smokeless ashtrays (36). Exhaust ventilation designed to capture plumes from smouldering cigarettes could also be employed. These measures do not have proven effectiveness in practice. Their effectiveness would depend on compliant use by smokers. General air-cleaning by filtration in an open-path configuration (e.g., with recirculating fan-filter units) could reduce ETS component concentrations to a modest to moderate degree, but would tend to be less effective than well-engineered source control measures. Simple segregation of smokers and non smokers in an open room, or between rooms coupled by open doorways, has very little effectiveness for controlling ETS exposures to non smokers: many studies show that just having non-smoking sections, even if equipped with separate ventilation systems, does not reduce SHS concentrations in hospitality venues to anywhere near background levels, e.g. (37). Most of the reported studies (including e.g., the 7 case studies in the REHVA handbook (9)) have addressed SHS reductions in no smoking zones of rather large facilities. Such situations are of less relevance for the purpose of this report as the Dutch Tobacco law would require large facilities to create separate smoking rooms. The examples most relevant are the three pubs studied in case 1; with ventilators turned off, FPM levels with cigarettes being smoked reached peak levels of up to 6,000

$\mu g/m^3$. With maximum ventilation, FPM levels of 500 – 1,000 $\mu g/m^3$ were still regularly observed in these three pubs that did not have no smoking zones.

Smoking rooms do not protect subjects in those room from exposure to SHS, no matter how well they are ventilated, or how well the air inside them is being filtered (5, 6, 38). It is even very difficult to prevent smoke from smoking rooms to enter the 'smoke free' zones of the buildings in which they are located (39). This is because a separate smoking room needs to be directly vented to the outside and maintain negative air pressure with the non-smoking section at all times so that smoke is not re-entrained into the non-smoking sections (38, 40). So, a separate smoking room in itself must be seen as in inadequate option to prevent exposure to SHS even for those not entering the smoking room, simply because there is always movement from and into the smoking room under realistic conditions of use. For the Netherlands, smoking rooms in the hospitality sector currently have no other requirements than that they are rooms separated from the remainder of the facility, without further requirements for size, ventilation and/or air cleaning; all that is required is that smoke from such rooms must not be a 'nuisance' to occupants of the smoke free part of the facility. Personnel is not required to enter smoking rooms to serve customers but can still be ordered to perform e.g. cleaning activities after use (41). These are clearly minimal requirements compared to what is usually stipulated for creation of smoking rooms.

Another point worth mentioning is that the SHS concentration in smoking rooms may be much higher than in hospitality venues with unrestricted smoking (4, 42). As a result, the health risks to the *smokers using the smoking rooms* may actually be increased beyond the high risks already encountered. In the Netherlands, as mentioned, no requirements exist for ventilation or air cleaning in smoking rooms, so this is particularly relevant for judging the situation in the Netherlands. As mentioned in the introduction, smoking bans reduce the risk of acute myocardial infarction even among smokers, so that it is relevant to consider the potentially counterproductive effect that smoking rooms may have on the health of the smokers themselves.

In summary, the limitations for recommending technical approaches include (a) difficulty of practically protecting smokers from ETS; (b) lack of proven efficacy of technical control measures in real-world situations; (c) lack of suitability of the measures in some circumstances; (d) cost implications of modifying existing buildings; (e) monitoring and enforcement challenges to ensure that systems perform as designed. An illustration of some of the empirical foundation for what is known about the potential for segregation and ventilation control can be found in (43).

The American Society of Heating and Refrigerating and Air-conditioning Engineers ASHRAE has carefully considered whether ventilation and/or air cleaning would be viable options to eliminate health risks of exposure to SHS in rooms where smoking is allowed, and it has concluded that this is not so (5):

"There is a consensus amongst medical cognizant authorities that second hand smoke is a health risk, causing lung cancer and heart disease in adults, and causing adverse effects on the respiratory health of children, including exacerbating asthma and increasing risk for lower respiratory infection. At present, the only means of eliminating health risks associated with indoor exposure is to ban all smoking activity. Although complete separation and isolation of smoking rooms can control second hand smoke exposure in non-smoking spaces in the same building, adverse health effects for the occupants of the smoking room cannot be controlled by ventilation. No other engineering approaches, including current and advanced dilution ventilation, "air curtains" or air cleaning technologies, have been demonstrated or should be relied upon to control health risks from second hand smoke exposure in spaces where smoking occurs, though some approaches may reduce that exposure and address odour and

some forms of irritation. An increasing number of local and national governments, as well as many private building owners, are adopting and implementing bans on indoor smoking."

If one allows smoking in indoor spaces, these spaces essentially become equivalent to smoking rooms, and the best one can hope to achieve by technical measures in such spaces (ventilation and/or filtration) is what is being achieved in smoking rooms themselves – and the available evidence clearly shows that that is far from enough. The Surgeon General report on Environmental Tobacco Smoke of 2006 (4) devotes a complete chapter to control of second hand smoke exposure, including a section discussing the available evidence on the effectiveness of technical approaches (zoning, separation, ventilation, and air cleaning). It concludes that "Exposures of non smokers to second hand smoke cannot be controlled by air cleaning or mechanical air exchange."

4. *Could a certification system guarantee that alternative measures are equally effective in practice as separate smoking rooms regarding practical application, enforcement and health protection? Or is there a need to complement certification with actual measurements?*

Answer

As sufficiently low SHS concentrations cannot practically be achieved through technical means in rooms where smoking is allowed, there is no need to consider the distinction between certification and certification plus measurements for such means.

Rationale

In more general terms one could argue that ventilation and filtration systems need to be designed, installed, operated and maintained properly; certification may go some way of ensuring the first two of these (design and installation), but it can never guarantee that systems will be operated and maintained properly. There is no published empirical evidence, to the knowledge of the committee, that would help to provide a solid basis for choosing between the options of certification only, and certification in combination with enforcement through measurements. Regardless, the committee, after reviewing the available evidence, comes to the conclusion that ventilation and air cleaning will not be sufficient to protect the health of subjects in rooms where smoking is allowed.

Conclusions

The committee concluded that the best way to reduce the adverse health effects of exposure to SHS in hospitality venues is to ban smoking in such places entirely. Requiring separate smoking rooms in some but not all venues creates confusion among the public, and a possibility for unfair treatment of some venues. Separate smoking rooms pose an additional health threat to smokers who use them, and to personnel that has to enter them after use. It is technically very demanding to create smoking rooms that do not lead to at least some exposure to SHS in adjacent 'smoke free' spaces, and the almost complete absence of specific requirements for such rooms in the Netherlands can only aggravate this problem.

The committee judges that it is impossible to provide sufficient ventilation and air cleaning to spaces where smoking is allowed to reduce exposure to SHS to levels that are safe. Experiences from other countries show that bans that are total, equal for all venues, and clearly enforced meet with the least resistance and greatest acceptance from hospitality venue owners, personnel and patrons alike. The committee therefore recommends the Ministry to not further explore technical and potentially very costly fixes to a problem that has a simple solution in the form of a complete smoking ban in all hospitality venues, including a provision to no longer allow smoking rooms.

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