Cancer Council Queensland

Smoke-drift in multi-unit housing

Assessment of second-hand smoke exposure

What is second-hand smoke?

Second-hand smoke is made up of the smoke breathed out by a smoker and the smoke that drifts from the end of a burning cigarette. It has the same 4000 chemicals as the smoke inhaled by smokers including 250 substances known to be toxic or carcinogenic.[1]

While the chemicals in the smoke inhaled by the smoker and second-hand smoke are qualitatively the same, the concentrations vary. The smoke from the burning end of a cigarette emits some toxins in greater concentrations than inhaled by the smoker as it smoulders at lower temperatures.[1,2,3] The chemical composition of second-hand smoke changes over time as it dilutes and disperses and interacts with the environment and surfaces.[4]

Measurement of second-hand smoke exposure

Assessment of second-hand smoke exposure can be done directly through air quality measurement and biomarkers[5], indirectly through surveys, or through surrogate measures of exposure, such as nicotine concentrations in house dust.[4] Exposure is a function of the quantity of second-hand smoke and the time spent in that environment.[1]

As second-hand smoke is a complex and dynamic mixture of thousands of compounds in both gas and particulate form, there is no one substance that can be measured to show a person's exposure to all second-hand smoke compounds. However, some compounds are valid markers, or tracers, for second-hand smoke and can be used to estimate exposure. For example, nicotine vapour is highly specific to tobacco and cotinine in saliva, blood and urine, is the primary metabolite of nicotine.[1]

Health consequences of second-hand smoke exposure

There is no safe level of exposure to second-hand smoke. It causes lung cancer, coronary heart disease, stroke, nasal irritation and reproductive effects in women. In children it causes middle ear disease, respiratory symptoms, impaired lung function, lower respiratory illness and sudden infant death syndrome (SIDS).[6]

Even brief periods of exposure to second-hand smoke can cause serious and immediate adverse health effects. Second-hand smoke has substantial and rapid effects on the cardiovascular system. As little as 30 minutes of exposure can affect blood and vascular function to almost the same extent as active smoking. Infants, children, and adults with asthma or respiratory problems can also have acute reactions from brief exposures.[1]

In addition, some short term health effects of second-hand smoke occur at extremely low concentrations. For example eye, throat and nasal irritation occur at a fresh air dilution volume of more than 3,000m^3 per cigarette. Odour is detected at a fresh air dilution volume of more than 19,000m^3 per cigarette.[7]

Air quality monitoring studies

People living in non-smoking units can be exposed to second-hand smoke from other units where smoking is permitted. Second-hand smoke infiltration can occur through ventilation systems, gaps in walls and doors, hallways, and it can drift in from balconies through open windows and doors.[1,8]

By measuring nicotine vapour, volatile organic compounds and particulate matter using a suite of ten instruments over several days, second-hand smoke incursions were identified at precise times across five non-smoking units where residents had reported smoke-drift. Of the eight incursions identified, only six could be quantified. This study focused on units where the infiltration occurred within the building and excluded units where the smoke drifted in through windows.[9]

Another study simultaneously measured particulate matter with real-time air quality monitors in the units of smokers and non-smokers and in some hallways and patios. Second-hand smoke from the units of smokers was detected in two of the 14 smoke-free units and six of the eight hallways. Ventilation and proximity to a smoker's unit were important determinants of second hand smoke-drift in a non-smokers unit.[10]

Using passive nicotine monitors and accounting for air exchange and sorption and re-emission from soft furnishings, another study detected second-hand smoke in 89% of non-smoking units. The average

effective smoking rate in non-smoking units was one quarter of a cigarette per day. In some non-smoking units the effective smoking rate was almost one cigarette per day.[11]

Measurement of second-hand smoke between units in multi-unit housing is complex and expensive and requires expertise, equipment and laboratory analysis.

Air quality measurement professionals

Occupational hygienists[12] and environmental health specialists[13] are professionals whose work includes air quality measurement. Their expertise and services tends to focus on industrial or occupational settings, ambient air quality or academic work.

Sealing and ventilation

It is not possible to eliminate second-hand smoke exposure within a building by air-purification, air-cleaning or mechanical air exchange.[1,14] Hence the National Occupational Health & Safety Commission and Australia Building Code Board did not endorse or adopt the 2002 Australian mechanical ventilation standard AS 1668.2-2002 as it contained ventilation guidelines for environmental tobacco smoke.[15, 16] The revised 2012 standard AS 1668.2-2012 excludes ventilation requirements for second-hand smoke and is now referenced in the Australian Building Code.

Ventilation can distribute second-hand smoke throughout a building.[1] However, beyond the common areas, centrally ventilated residential buildings are not subject to smoking bans.[17]

It is also impossible to eliminate second-hand smoke infiltration between units with a combination of sealing and ventilation improvements. Professional best practice sealing and ventilation improvements have been shown to reduce air-flow between smoking and non-smoking units by only 29 per cent.[6]

How to quit

Call Quitline 13 QUIT (13 7848) for free information, practical assistance and support.

Discuss quitting smoking with a health professional and plan your quitting strategy together.

Consider using pharmacotherapy such as Nicotine Replacement Therapy (NRT), Bupropion Hcl or Varenicline.

Endnotes: [1] U.S. Department of Health and Human Services. The Health Consequences of Involuntary Exposure to Tobacco Smoke: A Report of the Surgeon General. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2006. [2] California Environmental Protection Agency, Office of Environmental Health Hazard Assessment. Proposed identification of environmental tobacco smoke as a toxic air contaminant. Sacramento, California: EPA, 2005. [3] International Agency for Research on Cancer. Tobacco smoke and involuntary smoking. IARC monograph 83. Lyon: IARC, 2004. [4] International Agency for Research on Cancer. Personal Habits and Indoor Combustions. IARC monograph 100E. Lyon: IARC, 2012. [5] Wilson KM, Klein JD, Blumkin AK, Gottlieb M, Winickoff JP. Tobacco-Smoke Exposure in Children Who Living in Multiunit Housing. Pediatrics, 2011; 127(1)85-92. [6] U.S. Department of Health and Human Services. The Health Consequences of Smoking: 50 Years of Progress. A Report of the Surgeon General. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2014. Printed with corrections, January 2014. [7] Junker MH, Danuser B, Monn C, Koller T. Acute Sensory Responses of Nonsmokers at Very Low Environmental Tobacco Smoke Concentrations. [8] Bohac DL, Hewett MJ, Hammond SK, Grimsrud DT. Secondhand smoke transfer and reductions by air sealing and ventilation in multiunit buildings: PFT and nicotine verification. Indoor Air 2011; 21: 36-44. [9] Dacunto PJ, Cheng KC, Acevedo-Bolton V, Klepeis NE, Repace JL, Ott WR, Hildemann LM. Identifying and quantifying secondhand smoke in multiunit homes with tobacco smoke odor complaints. Atmospheric Environment. 2013; 71:399-407. [10] King BA, Travers MJ, Cummings M, Mahoney MC, Hyland AJ. Secondhand Smoke Transfer in Multiunit Housing. Nicotine and Tobacco Research 2010; 12(11) 1133-1144. [11] Kraev TA, Adamkiewicz G, Hammond SK, Spengler JD. Indoor concentrations of nicotine in low-income, multi-unit housing: associations with smoking behaviours and housing characteristics. Tobacco Control 2009; 18:438-44. [12] Australian Institute of Occupational Hygienists: www.aioh.org.au. [13] Environmental Health Australia: http://www.eh.org.au/. [14] American Society of Heating Refrigeration and Air-Conditioning Engineers. ASHRAE Position Document of Environmental Tobacco Smoke. October 22, 2010. [15] National Occupational Health & Safety Commission. Guidance Note on the Elminiation of Environmental Tobacco Smoke in the Workplace [NOHSC:3019(2003]. Commonwealth of Australia. [16] Australian Institute of Refrigeration, Airconditioning and Heating. Discussion Paper. Revision of AS 1668.2 2002. January 2012. March 2013. [17] Section 26R(2) Tobacco and Other Smoking Products Act 1998 (Qld).