

## Second-Hand and Third-Hand Tobacco Smoke

December 2014

Tobacco smoke damages every organ in the body and causes death and disease in smokers and in non-smokers.<sup>1</sup> The 7,000 chemicals in tobacco smoke include 69 known carcinogens.<sup>2</sup> When inhaled, the chemicals in tobacco smoke are quickly absorbed by cells in the body and produce cellular changes that can lead to cancer, heart disease and other serious health effects.<sup>3</sup> There is no risk-free level of exposure to cigarette smoke.<sup>4</sup> Tobacco smoke is currently classified into three categories: first-hand smoke (also known as mainstream smoke), which is inhaled by the smoker; second-hand smoke, which is the smoke either exhaled by a smoker or released from the end of a burning cigarette; and third-hand smoke, which is the tobacco smoke residue and gases that are left behind after a cigarette has been smoked.

### Second-hand Smoke

Second-hand smoke consists of sidestream smoke (the smoke released from the burning end of a cigarette) and mainstream smoke (the smoke exhaled by the smoker).<sup>5</sup> Sidestream smoke makes up about 85% of second-hand smoke.<sup>6</sup> It has a different chemical composition than exhaled mainstream smoke because it is generated at lower burning temperatures, and the combustion (burning) is not as clean or complete.<sup>7</sup> Exposure to second-hand smoke causes disease and premature death in children and adults who do not smoke.<sup>8</sup>

Second-hand smoke exposure has immediate adverse effects on the adult cardiovascular system and causes coronary heart disease.<sup>9</sup> Adult non-smokers who live with smokers increase their risk of

heart disease by about 25%.<sup>10</sup> Second-hand smoke exposure is also a cause of lung cancer in non-smokers.<sup>11</sup> Estimates indicate that more than 300 non-smokers die each year in Canada from lung cancer that is related to second-hand smoke.<sup>12</sup>

Because their bodies are developing, infants and young children are especially vulnerable to the toxins in second-hand smoke.<sup>13</sup> Infants whose mothers smoke while pregnant and babies who are exposed to second-hand smoke after birth are at increased risk of death from sudden infant death syndrome, are more likely to be of a low birth weight and have weaker lungs than babies who are not exposed to cigarette smoke.<sup>14</sup> Infants with low birth weight are at increased risk for dying within the first year of life<sup>15</sup> and are more likely to develop coronary heart disease and type 2 diabetes.<sup>16</sup>

Second-hand smoke exposure causes acute lower respiratory infections, such as bronchitis and pneumonia, in infants and young children and respiratory symptoms, including coughing, phlegm, wheezing and breathlessness. Children who already have asthma experience more frequent and severe attacks. Second-hand tobacco smoke also increases children's risk of ear infections; in addition, they are more likely to need operations to insert ear tubes for drainage.<sup>17</sup>

Traces of carcinogens and other toxins are found in the blood, urine, saliva and breast milk of non-smokers, even after limited exposure to second-hand smoke.<sup>18</sup>

For more information

[AlbertaQuits.ca](http://AlbertaQuits.ca)

Call toll-free

1-866-710-QUIT (7848)



December 2014

Third-hand smoke “consists of residual tobacco smoke pollutants that (i) remain on surfaces and in dust after tobacco has been smoked, (ii) are re-emitted back into the gas phase or (iii) react with oxidants and other compounds in the environment to yield secondary pollutants.”<sup>19</sup> The smoke residue, which includes many types and particulate matter (including heavy metals such as arsenic, lead and cyanide), builds up on surfaces and furnishings,<sup>20</sup> clothing, draperies and carpets. The gases can be absorbed by many of these materials.<sup>21</sup>

The burning of tobacco also releases nicotine in the form of a vapour that attaches to surfaces such as walls, floors, carpeting, drapes and furniture.<sup>22</sup> Nicotine reacts with nitrous acid (a common air pollutant, one source of which is burning tobacco) and forms carcinogenic tobacco-specific nitrosamines (TSNAs).<sup>23</sup> The nicotine can last for weeks to months on indoor surfaces<sup>24</sup> and results in the continued creation of carcinogens, which are then inhaled, absorbed or ingested.<sup>25</sup>

“The more a person smokes in the home or car, the more TSNAs are formed and sorbed onto environmental surfaces, and into materials such as cotton, cellulose, upholstery, and carpeting.”<sup>26</sup> Smoking in the home is associated with high levels of tobacco toxins well beyond the period of active smoking,<sup>27</sup> and testing of smoker’s vehicles has revealed substantial levels of carcinogenic TSNAs.<sup>28</sup> “Anyone who smokes in a home, car or other enclosed area in which non-smokers later are present is exposing those non-smokers to potent carcinogens.”<sup>29</sup>

Children are uniquely susceptible to third-hand smoke exposure because they breathe near, crawl on, play on, touch and even taste contaminated surfaces.<sup>30</sup> Children can also ingest tobacco residue by placing their hands in their mouth after touching surfaces that are contaminated with third-hand smoke.<sup>31</sup>

Exacerbating the problem of third-hand smoke is the need for cleaning solutions to be acidic to remove nicotine, yet “most soaps, however, are alkaline and will not effectively remove nicotine residue.”<sup>32</sup>

More research is needed into the health impact of exposure to third-hand smoke; however, scientific experts on third-hand smoke recommend 100% smoke-free homes and vehicles and suggest that “replacing nicotine- laden furnishings, carpets and wall board can significantly reduce”<sup>33</sup> third-hand smoke exposure.

The recent and emerging research on third-hand smoke may have implications for owners and employees of hotel and motel accommodations that are not already smoke free and for owners and residents of multi-unit dwellings that permit smoking.

## **Policies to Protect People from Exposure to Second-hand and Third-hand Smoke**

Through Alberta’s *Tobacco Reduction Act*<sup>34</sup> (TRA), all public places and workplaces in the province are smoke free. The act also prohibits smoking on patios with food service and within five metres of a doorway, window or air intake of a public place or workplace. Enclosed parking garages and work vehicles are also included in the definition of workplace.

In November 2014 the TRA was amended to include the banning of smoking in vehicles when minors are present. It also prohibits the selling, giving, lending or supplying of tobacco products to minors, similar to federal legislation. Starting in June, 2015, the legislation will also require minimum pack sizes for specific tobacco products, thereby eliminating smaller, more affordable options; and will ban certain flavoured tobacco products.

Municipalities have the authority to pass bylaws that are stronger than the TRA. Municipal playgrounds are smoke free in Lethbridge. Airdrie and Canmore have implemented smoke-free hotel and motel accommodation.

The following actions will protect children and others from exposure to second-hand and third-hand smoke:

- keep your home and vehicles smoke free
- support bylaws and legislation that require vehicles to be smoke free if minors are occupants
- support legislation to make all hotels and motels smoke free
- support policies for smoke-free multi-unit dwellings

- 
1. Department of Health and Human Services. (2010). How tobacco smoke causes disease: The biology and behavioral basis for smoking-attributable disease: 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. Retrieved June 9, 2011, from [http://www.surgeongeneral.gov/library/tobaccosmoke/report/full\\_report.pdf](http://www.surgeongeneral.gov/library/tobaccosmoke/report/full_report.pdf).
  2. U.S. Department of Health and Human Services. (2010). How tobacco smoke causes disease: The biology and behavioral basis for smoking-attributable disease: 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. Retrieved June 9, 2011, from [http://www.surgeongeneral.gov/library/tobaccosmoke/report/full\\_report.pdf](http://www.surgeongeneral.gov/library/tobaccosmoke/report/full_report.pdf).
  3. U.S. Department of Health and Human Services. (2010). How tobacco smoke causes disease: The biology and behavioral basis for smoking-attributable disease: 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. Retrieved June 9, 2011, from [http://www.surgeongeneral.gov/library/tobaccosmoke/report/full\\_report.pdf](http://www.surgeongeneral.gov/library/tobaccosmoke/report/full_report.pdf).
  4. U.S. Department of Health and Human Services. (2010). How tobacco smoke causes disease: the biology and behavioral basis for smoking-attributable disease: A report of the Surgeon General. Rockville, MD: 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. Retrieved June 9, 2011, from [http://www.surgeongeneral.gov/library/tobaccosmoke/report/full\\_report.pdf](http://www.surgeongeneral.gov/library/tobaccosmoke/report/full_report.pdf).
  5. U.S. Department of Health and Human Services. (2006). The health consequences of involuntary exposure to tobacco smoke: A report of the Surgeon General. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Coordinating Center for Health Promotion, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. Retrieved June 14, 2011, from <http://www.surgeongeneral.gov/library/secondhandsmoke/>.
  6. Canadian Council for Tobacco Control. (2001). What is secondhand smoke? Ottawa, ON: Author. Retrieved June 9, 2011, from <http://nns.ca/previous/2006/factsheet-shs>.
  7. iWitschi, H., Joad, J. P., & Pinkerton, K. E. (1997). The toxicology of environmental tobacco smoke. *Annual Review of Pharmacological Toxicology*, 37, 29–52.
  8. U.S. Department of Health and Human Services. (2006). The health consequences of involuntary exposure to tobacco smoke: A report of the Surgeon General. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Coordinating Center for Health Promotion, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. Retrieved June 14, 2011, from <http://www.surgeongeneral.gov/library/secondhandsmoke/>.
  9. U.S. Department of Health and Human Services. (2006). The health consequences of involuntary exposure to tobacco smoke: A report of the Surgeon General. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Coordinating Center for Health Promotion, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. Retrieved June 14, 2011, from <http://www.surgeongeneral.gov/library/secondhandsmoke/>.
  10. Law, M. R., Morris, J. K., & Wald, N. J. (1997). Environmental tobacco smoke exposure and ischemic heart disease: An evaluation of the evidence. *British Medical Journal*, 315(18), 973–977.

December 2014

11. U.S. Department of Health and Human Services. (2006). *The health consequences of involuntary exposure to tobacco smoke: A report of the Surgeon General*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Coordinating Center for Health Promotion, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. Retrieved June 14, 2011, from <http://www.surgeongeneral.gov/library/secondhandsmoke/>.
12. De Groh, M., & Morrison, H. I. (2002). Environmental tobacco smoke and deaths from coronary heart disease in Canada. *Chronic Diseases in Canada*, 23(1), 13–16. Retrieved June 8, 2011, from <http://www.ncbi.nlm.nih.gov/pubmed/11876831>.
13. U.S. Department of Health and Human Services. (2006). *The health consequences of involuntary exposure to tobacco smoke: A report of the Surgeon General*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Coordinating Center for Health Promotion, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. Retrieved June 14, 2011, from <http://www.surgeongeneral.gov/library/secondhandsmoke/>.
14. U.S. Department of Health and Human Services. (2006). *The health consequences of involuntary exposure to tobacco smoke: A report of the Surgeon General*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Coordinating Center for Health Promotion, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. Retrieved June 14, 2011, from <http://www.surgeongeneral.gov/library/secondhandsmoke/>.
15. Human Resources and Skills Development Canada. (n.d.). *Indicators of well-being in Canada: Health—low birth weight*. Ottawa, ON: Author. Retrieved June 28, 2011, from <http://www4.hrsdc.gc.ca/3ndic.1t.4r@-eng.jsp?iid=4>.
16. Lumley, J., Chamberlain, C., Dowswell, T., Oliver, S., Oakley, L., & Watson, L. (2009). Interventions for promoting smoking cessation during pregnancy. *Cochrane Database of Systematic Reviews* 2009, Issue 3. Art. No. CD001055.
17. U.S. Department of Health and Human Services. (2006). *The health consequences of involuntary exposure to tobacco smoke: A report of the Surgeon General*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Coordinating Center for Health Promotion, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. Retrieved June 13, 2011, from <http://www.surgeongeneral.gov/library/secondhandsmoke/>.
18. U.S. Department of Health and Human Services. (2006). *The health consequences of involuntary exposure to tobacco smoke: A report of the Surgeon General*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Coordinating Center for Health Promotion, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. Retrieved June 13, 2011, from <http://www.surgeongeneral.gov/library/secondhandsmoke/>.
19. Burton, A. (2011). Does the smoke ever really clear? Thirdhand smoke exposure raises new concerns. *Environmental Health Perspectives*, 119, a70–a74.
20. Dale, L. (2011). What is third-hand smoke and why is it a concern? Rochester, MN: Mayo Clinic. Retrieved June 13, 2011, from <http://www.mayoclinic.com/health/third-hand-smoke/AN01985>.
21. Americans for Nonsmokers' Rights. (2011). Thirdhand smoke. Retrieved June 13, 2011, from <http://www.no-smoke.org/learnmore.php?id=671>.
22. Sleiman, M., Gundel, L. A., Pankow, J. F., Jacob, P., III, Singer, B. C., & Destailats, H. (2010). Atmospheric Chemistry Special Feature: Formation of carcinogens indoors by surface-mediated reactions of nicotine with nitrous acid, leading to potential thirdhand smoke hazards. *Proceedings of the National Academy of Sciences*, 107(15), 6576–6581.
23. Sleiman, M., Gundel, L. A., Pankow, J. F., Jacob, P., III, Singer, B. C., & Destailats, H. (2010). Atmospheric Chemistry Special Feature: Formation of carcinogens indoors by surface-mediated reactions of nicotine with nitrous acid, leading to potential thirdhand smoke hazards. *Proceedings of the National Academy of Sciences*, 107(15), 6576–6581.
24. Sleiman, M., Gundel, L. A., Pankow, J. F., Jacob, P., III, Singer, B. C., & Destailats, H. (2010). Atmospheric Chemistry Special Feature: Formation of carcinogens indoors by surface-mediated reactions of nicotine with nitrous acid, leading to potential thirdhand smoke hazards. *Proceedings of the National Academy of Sciences*, 107(15), 6576–6581.
25. Americans for Nonsmokers' Rights. (2011) Thirdhand smoke. Berkeley, CA: Author. Retrieved June 13, 2011 from <http://www.no-smoke.org/learnmore.php?id=671>.
26. Mohamad Sleiman as quoted in Dreyfuss, J. H. (2010). Thirdhand smoke identified as potent, enduring carcinogen. *CA Cancer Journal for Clinicians*, 60(4), 203–204.
27. Winickoff, J. P., Friebely, J., Tanski, S.E., Sherrrod, C., Matt, G. E., Hovell, M. F., & McMillen, R. C. (2009). Beliefs about the health effects of “thirdhand” smoke and home smoking bans. *Pediatrics*, 123, e74–e79.

December 2014

28. Sleiman, M., Gundel, L. A., Pankow, J. F., Jacob. P., III, Singer, B. C., & Destailats, H. (2010). Atmospheric Chemistry Special Feature: Formation of carcinogens indoors by surface-mediated reactions of nicotine with nitrous acid, leading to potential thirdhand smoke hazards. *Proceedings of the National Academy of Sciences*, 107(15), 6576–6581.
29. Dreyfuss, J. H. (2010). Thirdhand smoke identified as potent, enduring carcinogen. *CA Cancer Journal for Clinicians*, 60(4), 203–204.
30. Winickoff, J. P., Friebely, J., Tanski, S. E., Sherrod, C., Matt, G. E., Hovell, M. F., & McMillen, R. C. (2009). Beliefs about the health effects of “thirdhand” smoke and home smoking bans. *Pediatrics*, 123, e74–e79.
31. Americans for Nonsmokers’ Rights. (2011). Thirdhand smoke. Berkeley, CA: Author. Retrieved June 13, 2011, from <http://www.no-smoke.org/learnmore.php?id=671>.
32. Dr. Lara Grundel as quoted in Dreyfuss, J. H. (2010). Thirdhand smoke identified as potent, enduring carcinogen. *CA Cancer Journal for Clinicians*, 60(4), 203–204.
33. Sleiman, M., Gundel, L. A., Pankow, J. F., Jacob. P., III, Singer, B. C., & Destailats, H. (2010). Atmospheric Chemistry Special Feature: Formation of carcinogens indoors by surface-mediated reactions of nicotine with nitrous acid, leading to potential thirdhand smoke hazards. *Proceedings of the National Academy of Sciences*, 107(15), 6576–6581.
34. Province of Alberta. Tobacco Reduction Act. Statutes of Alberta, 2005. Chapter T-3.8. Retrieved from [http://www.qp.alberta.ca/574.cfm?page=T03P8.cfm&leg\\_type=Acts&isbncln=9780779737901](http://www.qp.alberta.ca/574.cfm?page=T03P8.cfm&leg_type=Acts&isbncln=9780779737901).