Summary:

E Risk Sciences. Residential use of wood-burning appliances in Canada: Emissions, health effects, and intervention strategies. Boulder, CO: E Risk Sciences, LLP; 2009 Dec.

This report summarizes information on woodsmoke emissions and health effects associated with woodsmoke exposures from residential wood-burning (RWB) in Canada and provides a qualitative indication of the potential effectiveness of different intervention strategies based on a review of the available literature and interviews with Canadian health authorities. The purpose of this report is to better inform practitioners and policymakers about potential health risks or other concerns associated with residential wood-burning as well as useful mechanisms for addressing or mitigating these risks.

RWB is an important issue because of the potential negative impact on local air quality, which can result in nuisance complaints or public exposures and which may limit the ability of individual provinces to meet air pollutant goals. Ambient levels of particulate matter (PM) with diameters ≤10 microns (PM_{10}) and fine PM with diameters ≤2.5 microns ($PM_{2.5}$), sulfur oxides (SOx), nitrogen oxides (NOx), carbon monoxide (CO), polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), and dioxins have been associated with RWB in many areas of Canada. Although emissions from wood-burning appliances are well-documented, and are much greater for older units relative to newer advanced technologies that meet the Canadian Standards Association (CSA) or U.S. Environmental Protection Agency (EPA) standards, less is known about the magnitude of public exposures to woodsmoke, particularly indoors where people spend most of their time. Some studies show that indoor air quality is not affected by heat source or that infiltration from outdoor emissions is minimal, although infiltration is highly dependent on many factors. Other studies suggest RWB can increase indoor contaminant concentrations, contribute significantly to personal exposures, and result in adverse health effects .

With respect to the health effects literature, many constituents of woodsmoke have been shown to individually produce acute or chronic health effects in exposed humans. Of the more than 200 chemicals and compound groups contained in woodsmoke, fine particles (which can penetrate deep into the lung) are generally considered to be the best indicator of the health impacts of combustion sources. The three types of studies that have been used to assess potential health effects attributable to woodsmoke include: (1) a very limited number of controlled human exposure studies, (2) human epidemiology studies, and (3) animal toxicology studies. Based on the overall weight-of-evidence, exposure to woodsmoke in developed countries has been associated with a variety of adverse respiratory health effects and symptoms, particularly in children, with potential cardiovascular and cancer effects being less certain. Specific respiratory effects and symptoms include upper airway irritation, increased airway resistance, lung function decrements, decreased vital capacity, exacerbation of bronchial asthma, and increased visits to emergency departments and hospitalizations.

Based on the available information, effective intervention strategies are likely to be those that mandate the removal of the highest emitting wood-burning appliances, while programs that are voluntary in nature or rely solely on public education campaigns are unlikely to result in significant improvements to public health. Change-out programs involving some combination of economic incentive and education are likely to be effective, but regulation may be the most effective approach to stop the retail sale of conventional woodstoves. National or provincial legislative efforts may also result in more efficient policies rather than reliance on disparate and non-uniform municipality by-laws. However, it is currently not possible to quantitatively assess or rank order different intervention strategies because few attempts have been made to evaluate the efficacy of these strategies and most programs do not include an evaluation component. Public attitudes and perceptions can also represent a major barrier to change, as users may perceive fewer health risks. Other barriers include the cost of advanced appliances and long service life of conventional appliances. Additionally, practitioners may be unaware of the air quality impacts and potential health risks associated with RWB and may have limited information on intervention

strategies or few resources. Overall, there appears to be a disconnect in knowledge and coordination among different levels of government in Canada with respect to the health hazards of RBW and wood-burning intervention strategies.

Recommendations: (1) a central clearinghouse or repository of RWB information; (2) an interactive, web-based, government-sponsored resource where professionals can dialogue on ongoing or proposed public education programs and intervention strategies; (3) an evaluation component for all future education and intervention programs (including best practices and tools); (4) a scenario-specific decision analysis for various intervention strategies in a particular region or municipality; and (5) the development of a broader decision analytical framework that considers the positive and negative attributes of RWB in the larger context of other important environmental, social, and economic factors.

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