

Appendix D

Summary of Health Impacts from Wood Smoke

The following Table on Health Effects of Wood Smoke were extracted from the San Joaquin Valley Unified Air Pollution Control District, Final Staff Report for Proposed Amendments to Rule 4901 (Wood Burning Fireplaces and Wood Burning Heaters, dated October 16, 2008.

Numerous scientific studies report potentially serious adverse health effects from breathing smoke emitted by residential wood combustion. Smoke contains fine particles, which can affect both the lungs and the heart. Epidemiological studies have shown an increased risk of pulmonary disease and other concerns. With regard to adults, studies show that prolonged inhalation of wood smoke contributed to chronic interstitial lung disease, pulmonary arterial hypertension and cor pulmonale.

In addition, wood smoke has been linked to detrimental mutagenic and systemic effects such as oxidative stress and coagulation. These effects can ultimately result in cell damage and possibly lead to cancer. For example, mutagenicity testing of air containing smoke emitted from wood heaters found that wood smoke was twelve times more carcinogenic than an equal concentration of cigarette smoke. Exposure to wood smoke can affect inflammation, coagulation, and lipid peroxidation resulting in DNA and cellular damage.

Worsened respiratory functions have been correlated to inhalation of wood smoke as well. This occurs especially in children and sensitive groups. Moderate to severe respiratory symptoms have been found to be notably greater in those children in homes where wood burning was prevalent. Significant correlation was found between woodstove use and frequency of wheeze, severity of wheeze, frequency of cough and waking up at night with cough in children. Children with the highest exposure to wood smoke had a significant decrease in lung function. In addition, scientific studies have shown that wood smoke can cause an increased incidence of inflammatory responses, such as bronchitis, and decreased lung function.

The health effects from wood smoke are summarized in the following tables with references to relevant studies. The tables are followed by a health glossary summarizing the medical terms used in the tables and in this discussion.

Health Effects of Wood Smoke

Increased Risk of Pulmonary Issues such as arterial hypertension, cor pulmonale, COPD

Author	Journal	Summary
Sandoval, J. 1993	Chest	With regard to adults, studies show that prolonged inhalation of wood smoke contributed to chronic interstitial lung disease, pulmonary arterial hypertension and cor pulmonale.
Dennis, R.J. et al. 1996	Chest	Among elderly women of low socioeconomic status, wood smoke exposure was associated with the development of Obstructive Airways Disease.
Montaño, M. et al. 2004	Chest	Wood smoke increases matrix metalloproteinases activity and expression that might produce lung damage similar to that observed in COPD associated with tobacco smoke.

Detrimental Mutagenic and Systemic Effects such as Oxidative Stress, Coagulation, Lipid Peroxidation

Author	Journal	Summary
Lewtas et al. 1991	Air and Waste Management Association	Mutagenicity testing of air containing smoke emitted from woodheaters found that wood smoke was 12 times more carcinogenic than an equal concentration of cigarette smoke.
Danielsen, P.H. et al. 2008	Mutation Research	Particulate matter from wood smoke was found to cause health effects through generation of systemic effects and oxidative stress with resulting cellular damage.
Barregard, L. et al. 2006	Inhalation Toxicology	Exposure to wood smoke seems to affect inflammation, coagulation, and lipid peroxidation resulting in DNA and cellular damage.
Barregard, L. et al. 2008	Journal of Occupat. & Environ. Medicine	Wood smoke caused an inflammatory response and signs of increased oxidative stress in the respiratory tract, especially in the lower airways.
Sapkota, A. et al. 2008	International Journal of Epidemiology	Increasing level of smokiness from wood burning inside the home was associated with an increasing risk of hypopharyngeal and lung cancer.

Worsened Respiratory Functions such as Asthma, Wheezing, Coughing, Phlegm Production, etc.

Author	Journal	Summary
Morten A. et al. 2004	Exposure Anal. and Environ. Epidem.	The prevalence of all the symptoms of asthma was higher in children from households that used open fires compared to improved stoves with chimneys.
Lipsett et al. 1991	Air Waste Management Association	Presence of woodstove or fireplace in the home was associated with shortness of breath in females and both shortness of breath and moderate or severe cough in males.

Honicky, R.E. et al. 1985	Pediatrics	Moderate to severe respiratory symptoms, such as wheezing and cough at night, were notably greater in those children in homes where wood stove use was prevalent.
Steerenberg, P.A. 2006	Inhalation Toxicology	Exposure to wood smoke lead to an increase in response to the respiratory allergy model and health effect markers for pulmonary irritation and acute toxicity.
Butterfield, et al. 1989	Journal of Environmental Health	Significant correlation was found between woodstove use and frequency of wheeze, severity of wheeze, frequency of cough and waking up at night with cough in children.
Morris et al. 1990	American Journal of Diseases of Children	The use of a wood burning stove was associated with a 4 times higher risk of lower respiratory tract infection.

Increased Inflammatory Response like Bronchitis

Author	Journal	Summary
Rajpandey, M. 1984	Thorax	Prolonged exposure to wood smoke lead to chronic bronchitis in adults.
Lal et al. 1993	Indian J. of Exper. Biology	Rats exposed to wood smoke suffered bronchiolitis, hyperplasia and hypertrophy, congestion, oedema, and mild emphysema.
Pérez-Padilla, J.R. et al. 1999	Gaceta Medica de Mexico	Women exposed to wood smoke had a five-fold risk of chronic bronchitis and chronic airflow obstruction, as compared to the non-exposed.

Enhanced Allergic Sensitization and Decreased Lung Function

Author	Journal	Summary
Allsten, G.S. et al. 2006	Inhalation Toxicology	A mild increase in eye irritation and a slight increase in nose symptoms with exposure to wood smoke.
Heumann et al. 1991	Air & Waste Management Assoc.	Children with the highest exposure to wood smoke had a significant decrease in lung function.
Tesfaigzi Y. et al. 2002	Journal of Toxicology Science	Pulmonary function was affected in a high-exposure to wood burning group. Mild chronic inflammation and squamous metaplasia were observed in the larynx of all of the exposed groups.