In their 1.5 page report to CPSC on March 30, 2016, MLHU quite accurately noted the following about one of the "main" hazardous chemical substance found in wood smoke.

Particulate Matter (PM2.5) includes aerosols, smoke, fumes, dust, ash and pollen of different diameters.
Fine particulate mater (PM2.5) are known as respirable particles that can penetrate deep into the respiratory system and can vary depending on place, season and weather conditions.

To be fair they preambled with a brief, highly general introduction entitled "Wood Smoke Health Effects" which should have informed their recommendations, or what they called "Health Prevention Methods".
Best prevention method not mentioned by the MLHU is simply "do not burn wood in a residential setting."

Simply put - PM 0.1, PM2.5 and PM 10 wreak havoc on human and animal health and the environment, and they are generated abundantly by wood smoke.


# Particulate Matter and Air Pollution

Particulate matter is classified by size. “Fine particles,” or $PM_{2.5}$, are those smaller than 2.5μm (micrometers, or microns), in diameter, which is about 30 times smaller than the diameter of an average human hair. Coarse particles,

or $PM_{10}$, are between 2.5 and 10μm in diameter. Smaller than $PM_{2.5}$ are ultrafine particles, $PM_{0.1}$.

## In the Lungs and Bloodstream

Particles larger than $PM_{10}$ do not go into the deepest parts of the lungs, and they can be coughed out. Particles smaller than $PM_{10}$, however, are inhaled into the deepest parts of the lungs, where they become embedded and can cause disease. The smallest ultrafine particles, which are numerous in wood smoke, are so minute they behave like gases, passing through the lungs and directly into the bloodstream.

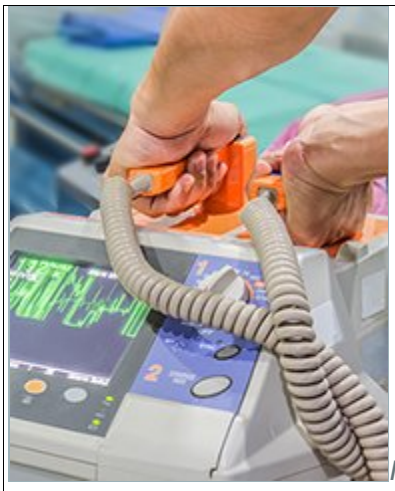
Once in the bloodstream, these ultrafine particles carry toxins around the body and promote inflammation.

## Bypassing the Blood/Brain Barrier

Ultrafine particles also travel up through the nose and, rather than passing down into the lungs, are delivered directly into the brain and central nervous system via the olfactory nerve, bypassing the body's protective blood/brain barrier.

## Adverse Health Effects and Raised Death Rate

Numerous peer-reviewed studies have described the adverse health effects, including premature death, that are associated with particulate pollution. Effects have been observed at levels as low as 10–20 $\mu g/m^3$ of $PM_{10}$, which are levels equal to or below background in many parts of the world. Many studies have shown no evidence of a threshold — an amount under which exposure does not harm health.



*Increased levels of $PM_{2.5}$ can trigger heart attacks and even contribute to sudden cardiac arrest.*

Bad for the Heart and Lungs

Particulate air pollution levels have been significantly associated with hospitalization rates for pneumonia in the elderly.

Associations have also been found between small increases in $PM_{2.5}$ levels and sudden cardiac arrest.

A 2013 review in the Lancet found a close and consistent association between short-term exposure to ambient air pollution levels and acute decompensated heart failure and heart failure deaths. The authors estimated that, in the US alone, a mean reduction in $PM_{2.5}$ of only 3.9 $\mu g/m^3$ would prevent 7,978 heart failure hospitalizations and save a third of a billion dollars a year.

## Even Low Levels Increase the Death Rate

*The death rate rises when there are more fine particles in the air, even at levels that are below current regulatory thresholds.*A study of New England Medicare recipients over age 65 determined that the death rate rises for each 10μg/$m^3$ increase in $PM_{2.5}$, both from short-term and long-term exposure, and even when pollution levels do not exceed US EPA or World Health Organization thresholds.

These findings were consistent with those of several other studies that have also found an association between particulate pollution levels and an increase in the mortality rate, even at levels that are considered low by regulatory standards.

## Like Lead Pollution, There is No Safe Level

According to Joel Schwartz, senior author of the New England study and professor of environmental epidemiology at Harvard T.H. Chan School of Public Health, this was the first study to examine the effect of airborne soot particles over an entire region, including rural areas.

“The harmful effects from the particles were observed even in areas where concentrations were less than a third of the current standard set by the EPA.” According to Schwartz, “Particulate pollution is like lead pollution; there is no evidence of a safe threshold even at levels far below current standards, including in the rural areas we investigated.”

## Officially Recognized as Carcinogenic

*Particulate pollution plays a role in the development of neurodegenerative diseases such as Parkinson's and Alzheimer's.*

## Brain Shrinkage and Strokes

Research has shown that long-term exposure to even slightly elevated $PM_{2.5}$ levels is associated with a .32% smaller total brain volume and a 46% higher risk of silent strokes, even in people who haven't yet developed dementia or had obvious strokes.

It has also been shown that older women living in areas with higher levels of particulate pollution have smaller white matter volumes.

Other research has also shown an association between strokes and particulate pollution, especially from "air pollutants related to combustion."

## Parkinson's and Alzheimer's Diseases

Evidence shows that particulate pollution is also a risk factor both in the development and progression of neurodegenerative diseases such as Alzheimer's and Parkinson's.

Short-term increases in $PM_{2.5}$ are associated with an increased risk of hospitalization and an increased risk of death for people with diabetes and, even more so, for people with Parkinson's disease.

Long-term exposure to elevations in particulate levels is significantly associated with increased first-time hospital admissions for Parkinson's disease, Alzheimer's disease and dementia. The risk was seen even at relatively low levels of pollution.

A recent study found that older women residing in places with fine particulate matter exceeding EPA standards had an 81% increased risk of global cognitive decline, and were 92% more likely to develop dementia from any cause, including Alzheimer's. The risk was even stronger in women who had the APOE4 gene, a genetic variation that increases the risk for Alzheimer's.

Researchers who study the neuroinflammatory effects of air pollution in young people have declared that exposure to air pollution should be considered a risk factor for Alzheimer's and Parkinson's diseases.

## More Links to Cognitive Impairment

Another study has also linked fine particulate pollution with worsened cognitive function. It was found that episodic memory is most impaired by exposure to $PM_{2.5}$. "Episodic memory impairment is one of the core diagnostic criteria used to determine mild cognitive impairment and dementia in older adults, and it has been suggested that impairments in this aspect of memory represent some of the earliest signs of dementia."

It was noted that particulates can affect the respiratory and cardiovascular systems, which can in turn affect the vascular pathology in the brain. Particulates may even directly damage the brain itself. “Studies of both humans and animals have confirmed that exposure to PM is linked to harmful changes in brain health and functioning.”

Other studies have also confirmed an association between cognitive decline and long-term exposure to particulate pollution. For example, it was found that exposure to particulate pollution at levels “typically experienced by many individuals in the United States is associated with significantly worse cognitive decline in older women.”

**Particulate Pollution References**