Air Quality Benefits of Biodiesel

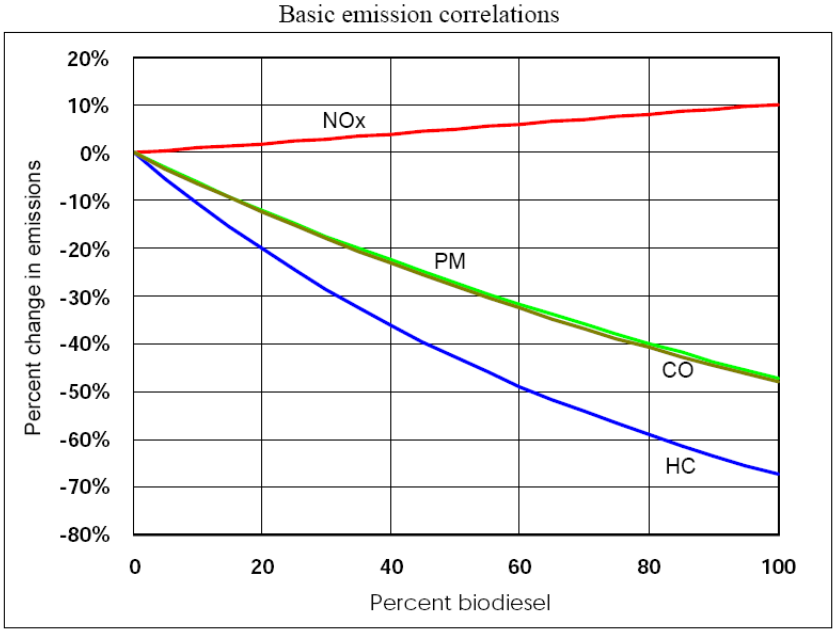
The Puget Sound Clean Air Agency supports increasing the use of biodiesel in our fleets because it offers significant health and air quality benefits.

Vehicles using biodiesel emit less air pollution than those using regular diesel. Recent studies conducted by the US Environmental Protection Agency (EPA) and the Department of Energy's National Renewable Energy Laboratory (NREL) show vehicles using pure or blended biodiesel can reduce emissions of

- Toxic air pollutants such as diesel particulate matter;
- Hydrocarbons such as volatile organic compounds, the precursors to ozone formation in our region; and
- Carbon dioxide, a pollutant that causes global warming.

In addition, these fuels do not appear to significantly affect nitrogen oxide (NOx) emissions in the Puget Sound region. As the percentage of biodiesel in the fuel mix increases, so do reductions in particulate matter, hydrocarbons, and carbon monoxide as summarized in the EPA graph below:

USEPA Study: A Comprehensive Analysis of Biodiesel Impacts on Exhaust Emissions[1]



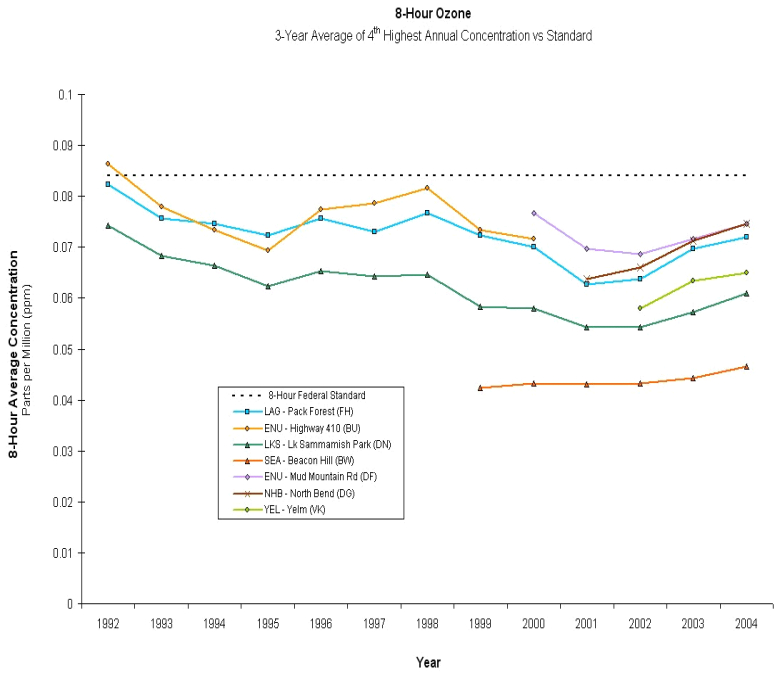
Biodiesel blends and pure biodiesel can reduce particulate matter (PM) by approximately 10 to 50 percent, respectively. EPA evaluated 39 studies of heavy duty truck emissions using various blends of biodiesel and diesel and found reductions up to 50 percent, as shown in the graph above.[2,3] Similar studies conducted by NREL found PM emissions were reduced from 10 to 55 percent from heavy duty diesel trucks and buses using a blend of biodiesel (referred to as B20 when using 20 percent biodiesel) and pure biodiesel, respectively.[4,5]

Reducing PM is a priority of the agency because of its serious health effects. Sensitive individuals such as the elderly or those with compromised immune systems are at higher risk than the general public. Adverse health effects from ambient PM include[6,7,8,9]

- Increased respiratory diseases such as chronic obstructive pulmonary disease;
- Decreased lung function; and
- Increased mortality rates (premature death).

In addition to these non-cancer health effects, diesel PM is classified as a probable human carcinogen by USEPA, California's Environmental Protection Agency, and the World Health Organization.[10,11,12] The Puget Sound Air Toxics Evaluation shows the increase risk of lung cancer risk from diesel PM may exceed 500 in a million, or 500 times the one in a million risk goal used for hazardous waste sites.[13,14]

Biodiesel can also reduce hydrocarbon (HC) emissions, including volatile organic compounds (VOCs), the precursors to ozone formation in the Puget Sound region. [15, 16] Ozone can exacerbate asthma and increase hospital visits and sick days among sensitive individuals.[17] In spite of programs aimed at reducing ozone, our region continues to measure ozone concentrations that approach the National Ambient Air Quality Standard for ozone, as shown in the graph below.[18] Both the USEPA and NREL studies show biodiesel can reduce HCs and VOCs between 20 to over 60 percent, respectively.[19]



Potential NOx increases from biodiesel are not expected to adversely impact air quality in our region. NOx can react with other pollutants to form ozone or particles, both of which can exacerbate existing lung diseases and reduce lung function in healthy adults.[20] However, ozone formation in the Puget Sound region is primarily driven by VOC emissions, so NOx increases are not likely to influence ozone in our airshed.[21,22]

NOx can react with other compounds to form nitric acid and related particles, causing respiratory problems.[23] However, the Puget Sound region is well below the National Ambient Air Quality Standard for NOx, and NOx emissions from biodiesel appear to be low or possibly less than those from regular diesel vehicles. Older USEPA and NREL studies show relatively small increases from 2 to 10 percent in NOx emissions from blended and pure biodiesel in heavy duty diesel trucks. More recent analyses conducted by NREL show a 4 percent reduction in NOx tailpipe emissions with nine buses using biodiesel in the Denver Colorado area.[24] Similarly, Montreal's Biobus study reports neutral impacts on NOx emissions in 20 urban buses using B20, with a slight reduction of 3 percent in NOx for buses equipped with electronic fuel injection.[25] NREL also showed several options to adjust fuel properties that can effectively reduce NOx emissions.[26]

Biodiesel can reduce greenhouse gases, the pollution that causes global warming, by up to 78 percent. A comprehensive study conducted jointly by US Department of Agriculture and the US Department of Energy compared the overall CO_2 emissions of a bus using pure biodiesel to one using regular diesel. The analysis included all aspects of the life cycle of the fuel, from the extraction of raw materials from the environment to the final end-use. The authors found the bus using pure biodiesel reduced CO2 emissions by 78 percent when compared with regular diesel. Similarly, buses using B20 reduce their overall CO2 emissions by 16 percent.[27] PM reductions from biodiesel may also protect our climate, as PM has been shown to act as a greenhouse gas and may contribute to global warming.[28]

In 2000, the Puget Sound region emitted approximately 48 million metric tons of CO2 equivalents (MMTCO2e).[29] Assuming approximately 10 MMTCO2e are from diesel vehicles, our region could reduce GHG emissions by 7.8 MMTCO2e by switching to pure biodiesel. Even using 20 percent biodiesel could reduce our CO2 emissions by 1.6 MMTCO2e.[30]

For more information on biodiesel, please contact Leslie Stanton at leslies@pscleanair.org or 206-689-4022.

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