

There is a growing body of emission data for biodiesel. Compared to conventional diesel, the use of B100 significantly reduces particulate emissions (PM), carbon/carbon monoxide (CO and CO<sub>2</sub>), and hydrocarbons (HC). With respect to nitrogen oxide (NO<sub>x</sub>) emissions, studies have shown small variations compared to conventional petroleum-based diesel. In comparing B20 to conventional diesel fuel, the changes in emissions are directionally the same, but smaller.

The California Air Resources Board (CARB) reports that B100 and B20 reduce PM emissions by 30% and 22%, respectively when compared to conventional diesel fuel<sup>1</sup>. The National Biodiesel Board (NBB) conducted research and testing that demonstrated PM reductions of 40% for B100 and 8% for B20<sup>2</sup>. In its 2002 draft report on biodiesel emissions, EPA reported an average PM reduction of 10.1% for soybean based B20 fuel, and a 2% increase in NO<sub>x</sub> emissions<sup>3</sup>. The EPA also reported that emissions varied with the type of biodiesel used (soybean, rapeseed, animal fats), and that emissions benefits appeared consistent across engine model years.



In a recently completed study on life-cycle emissions from biodiesel and petroleum diesel, the U.S. Department of Energy (DOE) concluded that tailpipe PM<sub>10</sub> emissions are 68% lower for biodiesel, while biodiesel life-cycle particulate emission are 32% lower than conventional diesel fuel<sup>4</sup>. A summary of biodiesel emissions and their impact in California is presented below:

### Biodiesel Emissions Compared to Diesel Fuel

	B100	B20	B5	B2
<b>CO</b>	-45%	-11%	-3.2%	-1.3%
<b>CO<sub>2</sub></b>	-48%	-12%	-3.9%	-1.5%
<b>PM</b>	-47%	-12%	-3.1%	-1.2%
<b>NO<sub>x</sub></b>	+10%	-2% TO +2%	-1% TO 1%	0% / negligible
<b>PAH (polycyclic aromatic hydrocarbons)</b>	-80%	-13%	not reported	not reported
<b>nPAH (nitrated PAHs)</b>	-90%	-50%	not reported	not reported
<b>Ozone Potential of Speciated Hydrocarbons</b>	-50%	-10%	not reported	not reported

Source: California Air Resources Board, National Biodiesel Board and A Comprehensive Analysis of Biodiesel Impacts on Exhaust Emissions, United States Environmental Protection Agency, EPA420-P-02-001, October 2002.

### Annual California Mobile Source Emission Impacts of B2 and B5 Biodiesel Blends\*

	CO tons/yr	CO <sub>2</sub> tons/yr	PM tons/yr
<b>B2 (with #2 CARB Diesel)</b>	-1,934 tpy	-427,040 tpy	-269.5
<b>B5 (with #2 CARB Diesel)</b>	-4,805 tpy	-1.06 million tpy	-666.3

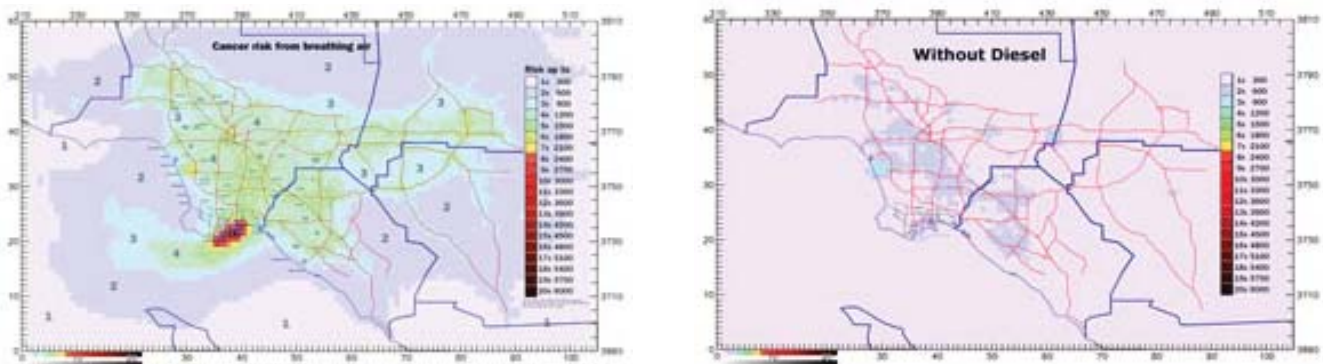
\*Does not include impact of B2/B5 blends for off-road diesel consumption (i.e. for agriculture, mining, forestry)  
Source: California Air Resources Board

In 2003 the Washington Metropolitan Area Transit Authority investigated bus emissions resulting from the use of conventional diesel fuel, ultra-low sulfur diesel fuel (ULSD) and a blend of 20 percent biodiesel and 80 percent ULSD (B20)<sup>5</sup>. During the ULSD and B20 tests the transit bus was equipped with a catalyzed particulate trap. The B20 fuel showed virtually similar PM reduction efficiencies compared to ULSD fuel and reduced PM emissions by greater than 98% as compared to the baseline diesel fuel. While showing a slight increase in NO<sub>x</sub> emissions, the B20 blend also reduced both CO and HC emissions by 90% over the ULSD fuel.

# Biodiesel Emissions Benefits

In terms of the healthcare costs of pollution related to diesel fuel, research in California shows that the use of conventional diesel fuel is the state's largest source of particulate matter (PM) emissions. These diesel fuel related PM emissions are responsible for an estimated 3,000 premature deaths, 70% of the state's cancer risk, 2,700 cases of bronchitis, and 4,400 hospital admissions, ultimately creating additional health care costs totaling \$21.5 billion<sup>6</sup>.

The maps depicted below show the estimated cancer risk for getting cancer in the Los Angeles metropolitan area over a 70-year lifetime, and are based on replotting the South Coast Air Quality Management District MATES-II data. The SCAQMD maps showed cancer color-coded up to 1200 cases per million, although the SCAQMD's estimated data values went as high as 5800. These maps present an updated view of the cancer risk based on all current emissions as well as an alternate scenario where diesel fuels are not burned at all.



*Given the importance of diesel engines and fuel to the California economy, a “no diesel fuel” scenario is completely unrealistic. However, the use of biodiesel fuels can substantially reduce the volume of harmful emissions and pollutants emanating from diesel engines, and decrease the related health risks and healthcare costs.*

For further information about biodiesel fuels, including pricing and how to purchase Crimson biodiesel in California and surrounding states, please contact Crimson Renewable Energy at [biodiesel@crimsonrenewable.com](mailto:biodiesel@crimsonrenewable.com).

## References

1. California Air Resources Board, Fuels Report: Appendix to the Diesel Risk Reduction Plan, Appendix IV, October 2000.
2. National Biodiesel Board website @ <http://nbb.org/>
3. U.S. Environmental Protection Agency, A Comprehensive Analysis of Biodiesel Impacts on Exhaust Emissions EPA-Draft Technical Report, EPA420-P-02-001, October 2002.
4. A Life-Cycle Inventory Analysis, Biodiesel vs. Petroleum Diesel, Dr. John Sheehan, National Renewable Energy Lab, presented at the Renewable Diesel Workshop, Seattle, WA 9/27/01.
5. Biodiesel Fuel Comparison Final Data Report- Washington Metropolitan Transit Authority, National Research Center for Alternative Fuels, Engine and Emissions, West Virginia University, August 15, 2002.
6. Sick of Soot: Reducing the Health Impacts of Diesel Pollution in California, Union of Concerned Scientists, 6/15/04. [http://www.ucsusa.org/clean\\_vehicles/trucks\\_and\\_buses/page.cfm?pageID=1429](http://www.ucsusa.org/clean_vehicles/trucks_and_buses/page.cfm?pageID=1429)



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