

**BOTTOM LINE:**

The 2018 Triennial Report indicates that the use of biofuels can negatively impact air quality, and that corn ethanol—which has accounted for more than 85% of total RFS compliance—is particularly problematic with respect to NO<sub>x</sub> emissions and ozone formation.

RFS-mandated biofuels affect air quality in a variety of ways (p56), such as when:

- Biofuel feedstocks are grown, harvested, and transported (in the US, the main feedstocks are corn starch, which is used to make ethanol, and soybean oil, which is used to make biodiesel (p57))
- Feedstocks are converted into biofuels
- Biofuels are transported to fuel blenders and other users
- Biofuels are burned in engines

EPA correctly points out in the new Triennial Report that there hasn't been nearly enough research into how these different processes affect the amount of pollution in our air. (p65)

- The impacts are highly localized (p57), so a more complete understanding of biofuels' impact requires additional location-specific testing and/or sophisticated air quality modeling.

According to the 2018 Triennial Report, the air pollution impacts associated with biodiesel are not significantly different than those associated with petroleum-based diesel (p62), except when the percentage of biodiesel in the fuel mix exceeds the engine manufacturer's recommendation. The use of higher-than-recommended biodiesel blends can compromise emissions control devices and "result in significantly higher pollution emissions." (p62)

The story is more problematic when it comes to ethanol—especially corn ethanol. According to the Triennial Report and the research underlying it, the production of corn starch ethanol results in "the highest overall air pollutant emissions among ethanol types." (p59)

And although the rate of air pollution from ethanol production is decreasing as the industry shifts from coal to natural gas for its process energy (p59), the emissions rate of an ethanol refinery is, on average, still worse than that of a petroleum refinery. According to EPA, "Facilities producing ethanol from corn and cellulosic feedstocks tend to have greater air pollutant emissions relative to petroleum refineries on a per-BTU of fuel produced basis." (p59) Dr. Hoekman's 2018 analysis indicates that these emissions are likely to increase significantly if there's an increase in the production of higher ethanol blends like E20.

The air quality impacts of burning ethanol in place of gasoline in a vehicle engine are mixed, but EPA's latest assessment mainly confirms the findings of its First Triennial report and a 2011 study by the National Academy of Sciences. The NAS study "concluded that air quality modeling

suggests that production and use of ethanol as fuel to displace gasoline is likely to increase such air pollutants as PM2.5, ozone, and [sulfur oxides] in some locations.” (p55)

- A joint study by EPA, DOE, and the Coordinating Research Council confirmed that burning gasoline-ethanol blends in cars increases the amount of NOx they emit, even in cars with Tier 2 emissions controls. (p60)
- NOx contributes to ozone formation when it mixes with volatile organic compounds in the presence of sunlight, so in most areas of the country an increase in NOx emissions can result in increased ozone formation.