Proposed Determination for Renewable Fuels and Air Quality Pursuant to Clean Air Act Section 211(v)

United States
Environmental Protection
Agency

Proposed Determination for Renewable Fuels and Air Quality Pursuant to Clean Air Act Section 211(v)

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

United States Environmental Protection Agency

EPA-420-D-20-003
May 2020

Proposed Determination for Renewable Fuels and Air Quality Pursuant to Clean Air Act Section 211(v)

Summary

EPA proposes to determine that no additional fuel control measures are necessary under Clean Air Act section 211(v) to mitigate adverse air quality impacts of required renewable fuel volumes.

Introduction

The Renewable Fuel Standard (RFS) program (Clean Air Act (CAA) section 211(o)) was created by the Energy Policy Act of 2005 (EPAct) and expanded by the Energy Independence and Security Act (EISA) in 2007. The RFS program was designed to "increase the production of clean renewable fuels" by requiring increasing volumes of renewable fuel to be introduced into the United States' supply of transportation fuel each year.[1]

The amendments added by EISA included section 211(v) of the CAA, which requires EPA to take two actions. First, section 211(v) states that:

> the Administrator shall complete a study to determine whether the renewable fuel volumes required by this section will adversely impact air quality as a result of changes in vehicle and engine emissions of air pollutants regulated under this chapter.

This study, commonly known as the "anti-backsliding study," must include consideration of different blend levels, types of renewable fuels, and available vehicle technologies, as well as appropriate national, regional, and local air quality control measures, according to section 211(v)(1)(B). EPA has completed the required study,[2] and it is described in further detail below.

Second, section 211(v) states that:

> the Administrator shall—
>
> (A) promulgate fuel regulations to implement appropriate measures to mitigate, to the greatest extent achievable, considering the results of the study under paragraph (1), any adverse impacts on air quality, as the result of the renewable volumes required by this section; or
>
> (B) make a determination that no such measures are necessary.

---

[1] Pub. L. No. 110-140, §§ 201-202, 121 Stat. 1492, 1492 (2007).

[2] Report No. EPA-420-R-20-008. Available at https://www.epa.gov/renewable-fuel-standard-program/anti-backsliding-determination-and-study.

The general purpose of this provision prompts EPA to study and address, as appropriate, potential adverse effects on air quality caused by the implementation of the RFS program. In fulfilling its obligation under this section, EPA has had to exercise its technical judgment in designing the anti-backsliding study, in assessing the results, and in determining a course of action. We describe below, and in the study, the judgments we made and the conclusions we reached.

In addition, EPA interprets section 211(v) as providing authority to take action to mitigate any adverse impacts of the RFS program subject to two crucial limitations established by section 211(v)(2). First, EPA may only promulgate "fuel regulations" in response to any adverse impacts, which narrows the range of possible regulatory actions (section 211(v)(2)(A)). While EPA retains broad discretion to regulate vehicle emissions under section 202, and is considering the mitigating impacts of certain vehicle standards adopted since the enactment of Sections 211(o) and 211(v), EPA is not directed to do so to mitigate any adverse impacts of the RFS program resulting from changes in vehicle and engine emissions. Second, EPA must only promulgate such fuel regulations if the agency believes they are appropriate measures necessary to mitigate any adverse impacts of the RFS program (section 211(v)(2)(A)-(B)). If there are no necessary, appropriate measures, EPA is not directed to promulgate regulations.

These limitations also serve to highlight the role of EPA's technical judgment under section 211(v)(2). The measures that EPA puts in place must be "appropriate." As the Supreme Court has stated, the "term [appropriate] leaves agencies with flexibility," although agencies must consider "all the relevant factors" when deciding whether regulation is "appropriate," including the cost of those regulations.[3] To comply with section 211(v)(2), then, EPA must consider whether there are any potential fuel regulations that are both "necessary" to mitigate adverse impacts of the RFS program as a result of the renewable volumes required by section 211(o) and are "appropriate" measures to do so. EPA is taking comment on an initial determination that there are no fuel regulations that are both "necessary" and "appropriate" to mitigate any of the adverse impacts identified after consideration of the section 211(v)(1) study discussed further below.

Section 211(o) lays out the renewable fuel volume requirements for the RFS program, which are designed to increase over time. For total renewable fuel, the CAA establishes increasing annual nationally applicable volume targets through 2022 (section 211(o)(2)(B)(i)(I)). However, Congress authorized EPA to reduce those statutory volumes in limited circumstances. First, if EPA's projection of cellulosic biofuel production is lower than the statutory volume laid out in section 211(o)(2)(B)(i)(III), EPA must lower the cellulosic biofuel volume, and has broad discretion to decide whether to lower the applicable volume for total renewable fuel as well (section 211(o)(7)(D)(i)).[4] Second, if EPA determines there is "inadequate domestic supply" or the volumes "would severely harm the economy or environment of a State, a region, or the United States," then EPA may exercise its discretion to lower the required volumes (section

[3] *Michigan v. EPA*, 135 S.Ct. 2699, 2707 (2015).
[4] Cellulosic biofuels are a subset of total renewable fuel. See 211(o)(1)(E).

211(o)(7)(a)). Those two authorities are often known as the "cellulosic waiver provision" and the "general waiver provision," respectively.

From 2010 to 2019, EPA has exercised one or both of its waiver authorities, replacing the volumes in the statutory table with new required total renewable fuel volumes.[5] The statute requires EPA to analyze the impacts of "the renewable fuel volumes required by this section." This phrase could refer to the statutory volumes set forth in CAA section 211(o)(2)(B) or to the volumes actually used in calculating the percentage standards under section 211(o)(3)(B) which apply to obligated parties and result in renewable fuels being used in transportation fuels. EPA notes that actual volumes have fallen well short of the statutory volumes[6] and concludes it is more reasonable and appropriate to use the volumes which represent actual fuel consumed and actual impacts on emissions to the air, rather than hypothetical statutory volumes. Thus, EPA completed the antibacksliding study by comparing the volumes of renewable fuel actually used under the RFS to the volumes of renewable fuel in the fuel supply before the RFS program was implemented.[7]

In particular, EPA chose to use 2016 as the year for assessing the effects on air quality of renewable fuel volumes. EPA compared two scenarios for calendar year 2016, one with actual renewable fuel volumes (the "with-RFS" scenario) and another with renewable fuel use approximating 2005 levels (the "pre-RFS" scenario). By analyzing calendar year 2016, EPA was able to use an existing modeling platform that includes known renewable fuel volumes and fuel properties based on actual data. The "pre-RFS" scenario used 2005 renewable fuel usage, because that is the year EPAct was signed into law. Other potential study approaches would have involved highly uncertain estimates of fuel volumes and would have been less informative.

By analyzing calendar year 2016, EPA was also able to analyze a year where the non-cellulosic renewable fuel volumes (e.g., ethanol and biodiesel volumes) were substantially phased in and not dramatically different from today's volumes. In keeping with this, the "with-RFS" scenario assumed 10 percent ethanol (E10) was used nationwide in all onroad and nonroad gasoline-fueled vehicles and engines, and biodiesel was used at a five percent blend (B5) in all onroad diesel vehicles nationwide. This was compared to the "pre-RFS" scenario, which assumed E10 usage only in the 2016 reformulated gasoline (RFG) areas and no biodiesel usage. Fuels in California were assumed to be the same in both scenarios. Consistent with the statutory focus on the impact of renewable fuel volumes on "changes in vehicle and engine emissions of air pollutants," EPA only varied the fuel supplies for onroad and nonroad engines between the

---

[5] 75 FR 14670 (March 26, 2010), 75 FR 76790 (December 9, 2010), 77 FR 1320 (January 9, 2012), 78 FR 49794 (August 15, 2013), 79 FR 25025 (May 2, 2014), 80 FR 77420 (December 14, 2015), 81 FR 89746 (December 12, 2016), 82 FR 58486 (December 12, 2017), 83 FR 63704 (December 11, 2018), 85 FR 7016 (February 6, 2020).

[6] The shortfall has been primarily in the mandated cellulosic volumes which have remained a very small fraction of the statutory volumes and the vast majority of which has been biogas replacing fossil natural gas, not liquid fuels replacing gasoline or diesel fuel.

[7] Report No. EPA-420-R-20-008. Available at https://www.epa.gov/renewable-fuel-standard-program/anti-backsliding-determination-and-study.

two scenarios—everything else, including "upstream" emissions from producing, storing, and transporting fuels and feedstocks, was held constant in both scenarios at 2016 levels.[8]

The study assessed the changes in emissions from motor vehicles and nonroad engines and equipment using the MOtor Vehicle Emission Simulator (MOVES). Air quality modeling was done using the Community Multiscale Air Quality model (CMAQ) to estimate the resulting impacts on concentrations of ozone, particulate matter (PM), nitrogen dioxide (NO_2), carbon monoxide (CO), and some air toxics (including acetaldehyde, acrolein, benzene, 1,3-butadiene, formaldehyde, and naphthalene).

The results of this analysis were that, compared to the "pre-RFS" scenario, the 2016 "with-RFS" scenario increased ozone concentrations (eight-hour maximum daily average) across the eastern U.S. and in some areas in the western U.S., with some decreases in localized areas. In the 2016 "with-RFS" scenario, concentrations of annual average fine particulate matter ($PM_{2.5}$) were relatively unchanged in most areas, with increases in some areas and decreases in some localized areas. The 2016 "with-RFS" scenario increased annual average concentrations of NO_2 across the eastern U.S. and in some areas in the western U.S., with larger increases in some urban areas. The 2016 "with-RFS" scenario decreased annual average concentrations of CO across the eastern U.S. and in some areas in the western U.S., with larger decreases in some areas.

Compared to the "pre-RFS" scenario, the 2016 "with-RFS" scenario increased annual average concentrations of acetaldehyde across much of the eastern U.S. and some areas in the western U.S. and resulted in widespread increases in annual average formaldehyde concentrations. The 2016 "with-RFS" scenario decreased annual average benzene concentrations across most of the U.S., as compared to the "pre-RFS" scenario. The 2016 "with-RFS" scenario also resulted in decreased annual average concentrations of 1,3-butadiene in many urban areas. The 2016 "with-RFS" scenario resulted in small, geographically limited increases and decreases in annual average concentrations of acrolein and naphthalene.

Necessity and Availability of Appropriate Control Measures to Address Modeled Adverse Impacts

Having characterized the potential adverse impacts of the renewable fuel volumes required by the RFS, we next considered whether it is necessary to implement appropriate fuel control measures to address those impacts. First, we examined the impact of the Tier 3 motor vehicle emissions and fuel standards, promulgated in 2014.[9] These standards post-date the adoption of the RFS and section 211(v) and likewise are not reflected in the antibacksliding study's comparison of "pre-RFS" to "with-RFS" scenarios. The Tier 3 sulfur standard was implemented in 2017, and the vehicle standards are phasing in between 2017 and 2025. Benefits

[8] More explanation of the assumptions, their rationale, and the potential impacts on the results can be found in the Clean Air Act Section 211(v)(1) Anti-backsliding Study, EPA-420-R-20-0008. Available at https://www.epa.gov/renewable-fuel-standard-program/anti-backsliding-determination-and-study.
[9] Control of Air Pollution from Motor Vehicles: Tier 3 Motor Vehicle Emission and Fuel Standards, 79 FR 23414 (April 28, 2014). Although these standards were authorized under section 202 and 211 of the Clean Air Act, they were not adopted to fulfill any specific statutory direction.

of the vehicle standards will further increase over time as the fleet turns over. The Tier 3 rule imposes fleet-wide exhaust emission standards for non-methane organic gases (NMOG) and nitrogen oxides (NO_x) that are 80% lower than the previous standards; PM exhaust emissions standards for light and medium-duty vehicles that are 70% lower than previous standards; and standards for heavy-duty pick-ups and vans that are on the order of 60% lower than previous standards. It also imposes tighter evaporative emission standards for gasoline-powered vehicles that represent a 50% reduction from previous standards. The tighter exhaust standards are enabled by gasoline sulfur reductions of over 60%, allowing for more efficient and durable emission control systems. The Tier 3 motor vehicle emission and fuel standards require recent advances in vehicle and refining technology to be broadly applied across the industries. The vehicle emission standards combined with the reduction of gasoline sulfur content are reducing motor vehicle emissions, including nitrogen oxides (NO_X), volatile organic compounds (VOC), direct particulate matter ($PM_{2.5}$), carbon monoxide (CO) and air toxics. Significantly, EPA changed the longstanding primary certification fuel for light-duty vehicles from non-oxygenated gasoline (E0) to gasoline containing 10 percent ethanol (E10) to better match in-use fuel after implementation of the RFS program. In this way, the Tier 3 program was designed to control vehicle emissions taking into consideration the nationwide shift to E10 under the RFS program.

A comparison of the air quality impacts estimated by the anti-backsliding study for 2016 and the Tier 3 regulatory analysis for 2018 and 2030 demonstrates the mitigating impact of the Tier 3 program. Our comparison uses maps to depict the impacts modeled in the anti-backsliding study and the impacts modeled for the Tier 3 rule. Although there are differences in modeling assumptions between the two analyses, they are similar enough to allow meaningful comparisons. For example, while the Tier 3 rule relied on a modified version of MOVES2010,[10] the fuel effects updates in that Tier 3 model were incorporated into MOVES2014, giving similar results for fuel impacts. Also, while Tier 3 was modeled using the NONROAD model, the data and algorithms used were largely unchanged in the version of NONROAD incorporated in MOVES2014, and the fuel effects are the same.

Table 1 compares key modeling assumptions in the two efforts.[11,12, 13] Furthermore, the limitations noted in the anti-backsliding study—including lack of data on spatial distribution of biodiesel use, limited data on effects of renewable fuels on nonroad engines, uncertainties in hydrocarbon speciation, and uncertainties in photochemical mechanisms used in CMAQ—are similar for both analyses.[14] The methodological differences and limitations of the analyses are

[10] U.S. EPA. 2014. "Memorandum to Docket: Updates to MOVES for the Tier 3 FRM Analysis" Docket No. EPA-HQ-OAR-2011-0135.
[11] Report No. EPA-420-R-20-008. Available at https://www.epa.gov/renewable-fuel-standard-program/anti-backsliding-determination-and-study.
[12] U. S. EPA. Emissions Modeling Technical Support Document: Tier 3 Motor Vehicle Emission and Fuel Standards. Air Quality Assessment Division, Office of Air Quality Planning and Standards, Research Triangle Park, NC. Report No. EPA-454/R-14-003, February 2014.
[13] U. S. EPA. Air Quality Modeling Technical Support Document: Tier 3 Motor Vehicle Emission and Standards. Air Quality Assessment Division, Office of Air Quality Planning and Standards, Research Triangle Park, NC. Report No. EPA-454/R-14-002, February, 2014. Available at https://nepis.epa.gov/Exe/ZyPDF.cgi/P100HX23.PDF?Dockey=P100HX23.PDF
[14] Report No. EPA-420-R-20-008. Available at https://www.epa.gov/renewable-fuel-standard-program/anti-backsliding-determination-and-study.

not significant enough to change a conclusion that the Tier 3 standards mitigate the air quality impacts of renewable fuel volumes suggested by the anti-backsliding study.

Table 1. Air Quality Modeling Assumptions for Anti-backsliding Study and Tier 3 Rule

	Anti-Backsliding Study	Tier 3 Rule
Mobile Source Inventory	Onroad and Nonroad: MOVES2014b	Onroad: MOVES 2010b with fuel effects updates; Nonroad: National Mobile Inventory Model, version NMIM20090504a
Air Quality Model	CMAQ version 5.2.1	CMAQ version 5.0.1
Modeling Platform[15]	2016 Version 7.2	2007/8 Version 5
Grid Resolution	12 km, with 36 km for boundary conditions	12 km, with 36 km for boundary conditions
Scenarios Compared	2016 with actual fuel volumes under RFS; 2016 with renewable fuel usage at 2005 levels (before RFS)	2018 with and without Tier 3 fuel and vehicle standards; 2030 with and without Tier 3 fuel and vehicle standards
Meteorological Inputs	Weather Research and Forecasting Model (WRF) version 3.8	Weather Research and Forecasting Model (WRF) version 3.3

Figures 1 through 15 below depict comparisons in absolute changes in concentrations of ozone, $PM_{2.5}$, NOx, acetaldehyde, and formaldehyde. Changes in absolute levels of acrolein and naphthalene are not shown as they do not show up within the resolution of the smallest scale on the maps.

Figures 1 through 3 show the offsetting impacts of the anti-backsliding study and Tier 3 for annual 8-hour maximum daily average ozone. The largest ozone increases identified by the anti-backsliding study occur in the Southeast, with increases ranging from 0.25 to 0.75 ppb, with a few locations over 0.75 ppb. However, decreases due to Tier 3 largely offset these increases in 2018, and by 2030 fully offset the increases at the vast majority of locations across the U.S. Figures 4 through 6 show the offsetting impacts for annual average $PM_{2.5}$. The anti-backsliding study identifies small increases in $PM_{2.5}$ at a few locations in the Pacific Northwest; these increases range from 0.01 to 0.05 $\mu g/m^3$. However, decreases due to Tier 3 largely offset these increases in 2018, and more than offset them by 2030. Figures 7 through 9 show the offsetting impacts for annual average NO_2. While the anti-backsliding study identifies NO_2 increases up to 0.3 ppb, reductions from Tier 3 are substantially larger by 2030. Calendar year 2030 is an appropriate year of focus, because any new program EPA could promulgate under section 211(v) would likely not be implemented until at least 2025, given the need for lead time.

[15] https://www.epa.gov/air-emissions-modeling/emissions-modeling-platforms

The anti-backsliding study identified increases in formaldehyde concentrations in many locations; however, reductions due to Tier 3 standards will offset these increases (Figures 13-15). In contrast, in many locations Tier 3 standards will not fully offset the acetaldehyde increases identified in the anti-backsliding study (Figures 10-12). Acetaldehyde is a primary byproduct of the combustion of ethanol, which is the primary renewable fuel increased in the marketplace as a result of section 211(o) implementation. EPA is not aware of a fuel control that would address this pollutant without reducing ethanol use. Requiring reductions in ethanol use under section 211(v) would run directly counter to meeting the renewable fuel requirement of section 211(o). Section 211(v) only seeks mitigation of the air quality impacts of the renewable fuel volumes required under 211(o), not the reversal of those volumes. Moreover, EPA has already taken action with the Tier 3 standards to broadly reduce pollutants to the extent technologically achievable, and EPA is not aware of any vehicle or engine emissions control technology that could specifically target acetaldehyde further.

Conclusion and Proposed Determination

Based on the results of the antibacksliding study, considered in conjunction with pollution control measures EPA has already adopted and its evaluation of additional fuel control measures that are currently available, EPA proposes to determine that no additional fuel control measures are necessary to mitigate adverse air quality impacts of required renewable fuel volumes. The Tier 3 rule has been promulgated and implemented, and these actions include fuel and vehicle standards that reflect the shift of the gasoline pool from E0 to E10 while reducing concentrations of ozone, $PM_{2.5}$, NO_2, and air toxics now and in the future. The analyses supporting Tier 3 predict widespread reductions in 2018 and 2030 in ozone, PM, NO_2, and toxics, which mitigate the potential adverse air quality impacts identified in the anti-backsliding study. For $PM_{2.5}$, reductions from Tier 3 by 2030 are substantially larger than any adverse impacts modeled in the anti-backsliding study. For other pollutants except acetaldehyde, Tier 3 reductions fully offset any adverse impacts from the anti-backsliding study at the vast majority of locations across the U.S.

Therefore, based on these comparisons, and the lack of available controls which specifically target acetaldehyde, EPA concludes that there are no additional appropriate measures which are necessary to mitigate the potential adverse air quality impacts of required renewable fuel volumes.

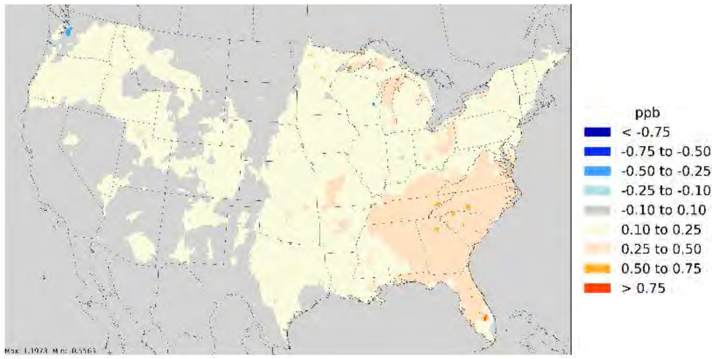

Figure 1. Change in absolute concentrations of 8-hour maximum daily average 2016 ozone between "pre-RFS" and "with-RFS" scenarios

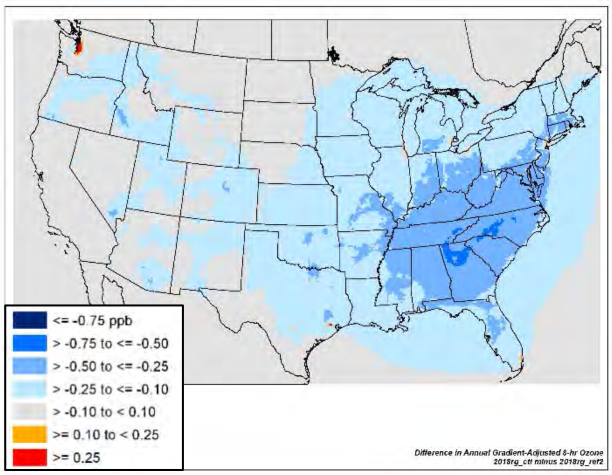

Figure 2. Change in absolute concentrations of 8-hour maximum daily average ozone in 2018, with and without Tier 3 standards

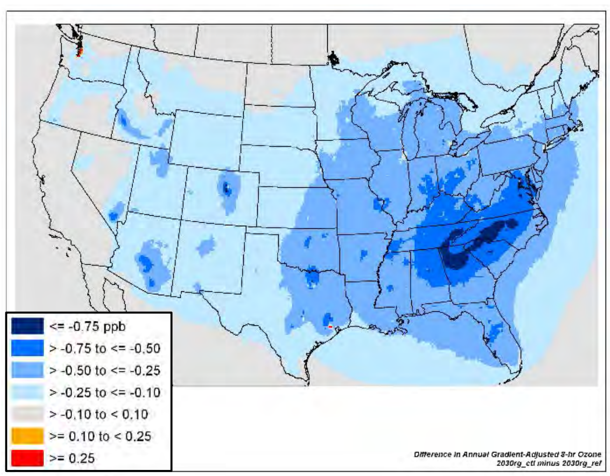

Figure 3. Change in absolute concentrations of 8-hour maximum daily average ozone in 2030, with and without Tier 3 standards

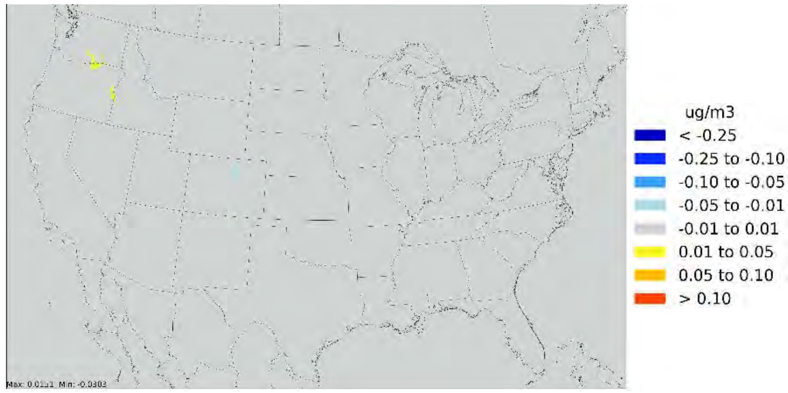

Figure 4. Absolute change in average annual 2016 $PM_{2.5}$ concentrations between “pre-RFS” and “with-RFS” scenarios

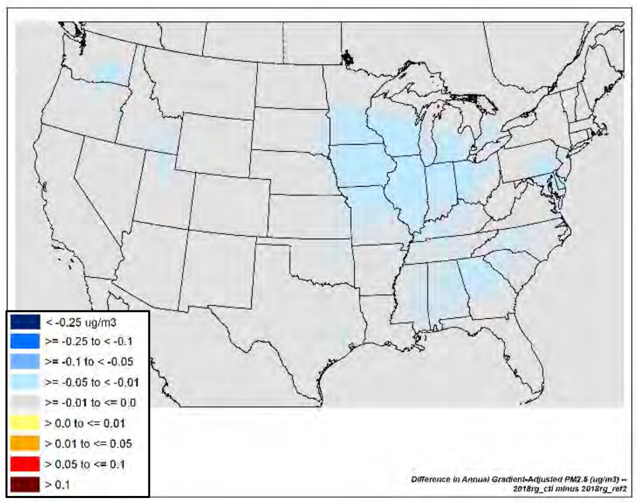

Figure 5. Change in absolute concentrations of annual average $PM_{2.5}$ in 2018, with and without Tier 3 standards

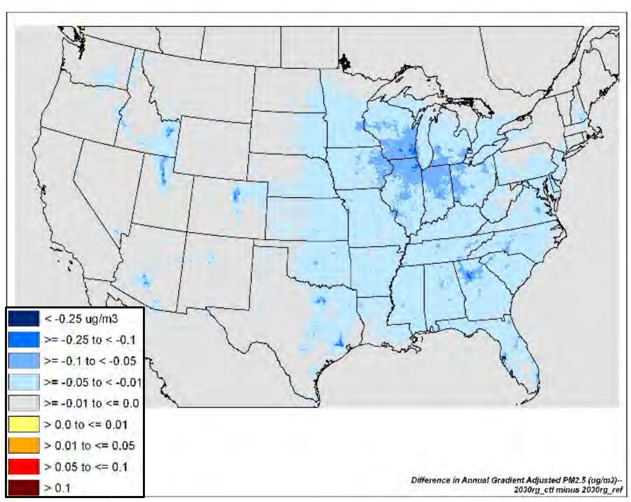

Figure 6. Change in absolute concentrations of annual average $PM_{2.5}$ in 2030, with and without Tier 3 standards

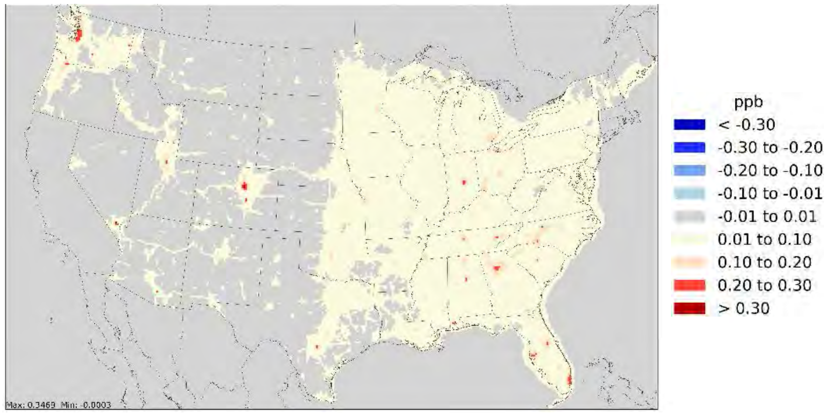

Figure 7. Absolute change in average annual 2016 NO_2 concentrations between "pre-RFS" and "with-RFS" scenarios

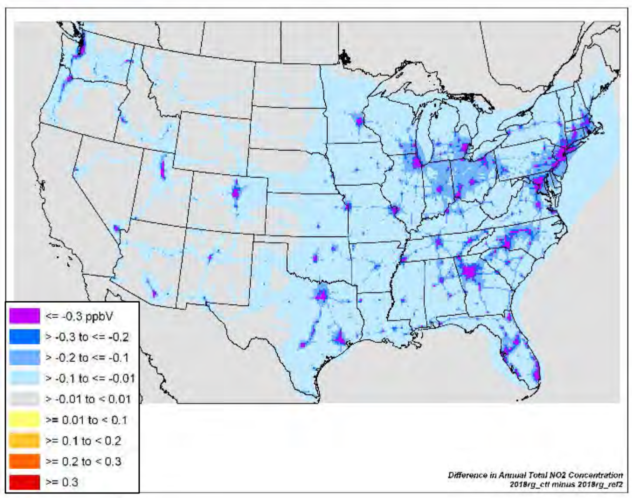

Figure 8. Change in absolute concentrations of average NO_2 in 2018, with and without Tier 3 standards

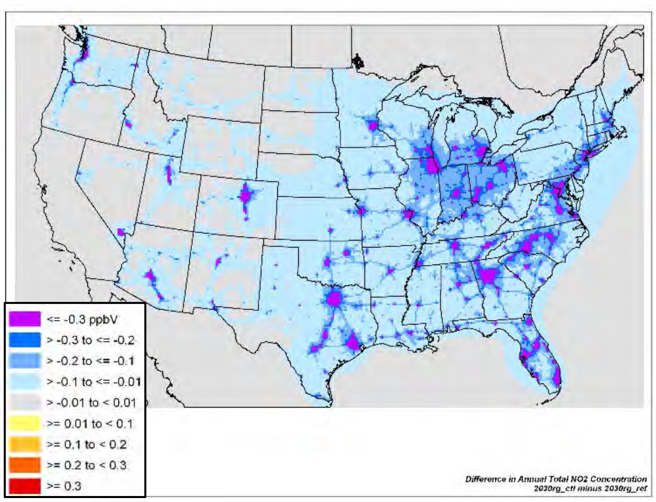

Figure 9. Change in absolute concentrations of average NO_2 in 2030, with and without Tier 3 standards

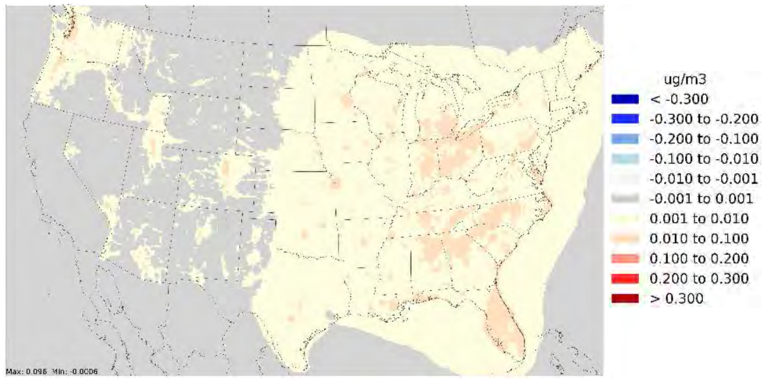

Figure 10. Absolute change in average annual 2016 acetaldehyde concentrations between “pre-RFS” and “with-RFS” scenarios

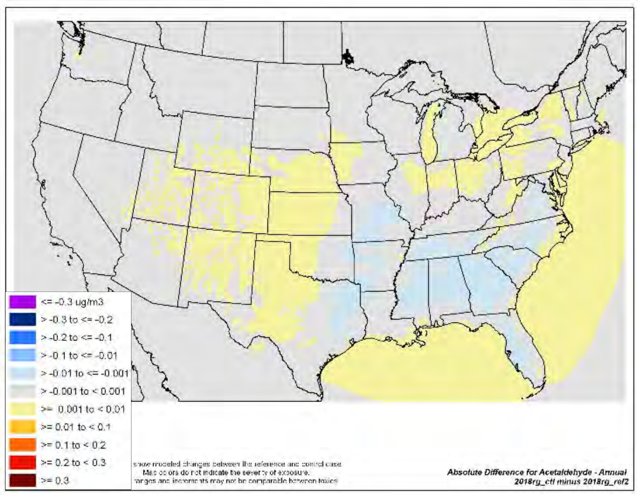

Figure 11. Change in absolute concentrations of annual average acetaldehyde in 2018, with and without Tier 3 standards

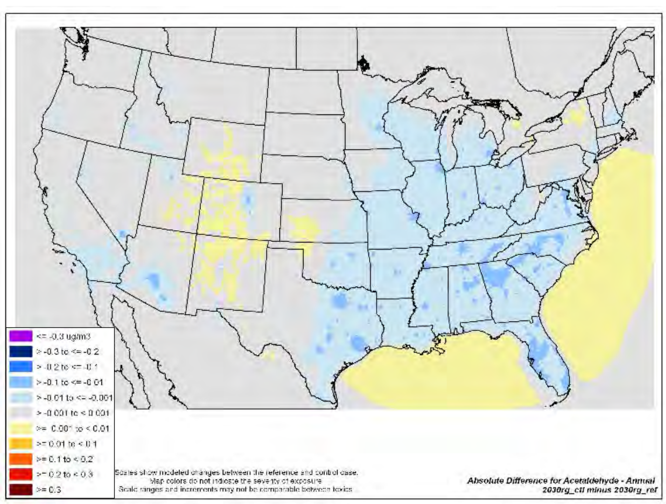

Figure 12. Change in absolute concentrations annual average acetaldehyde in 2030, with and without Tier 3 standards

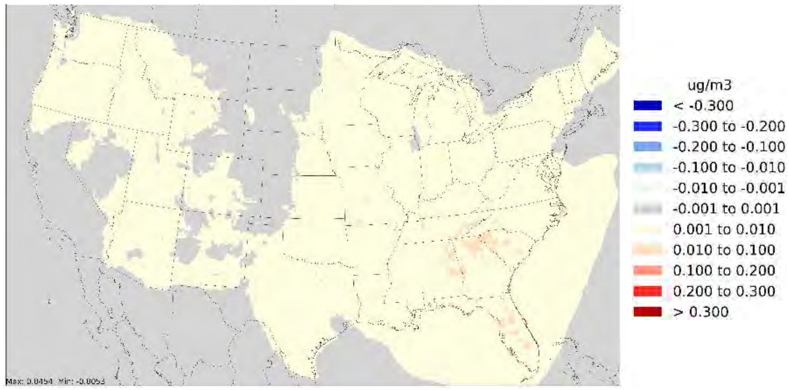

Figure 13. Absolute change in average annual 2016 formaldehyde concentrations between "pre-RFS" and "with-RFS" scenarios

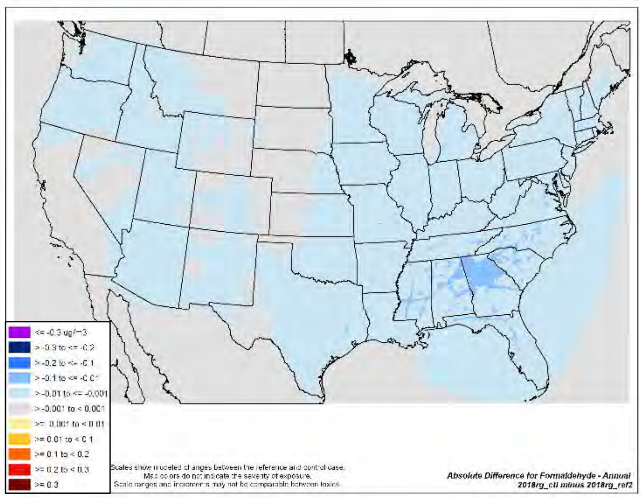

Figure 14. Change in absolute concentrations of annual average formaldehyde in 2018, with and without Tier 3 standards

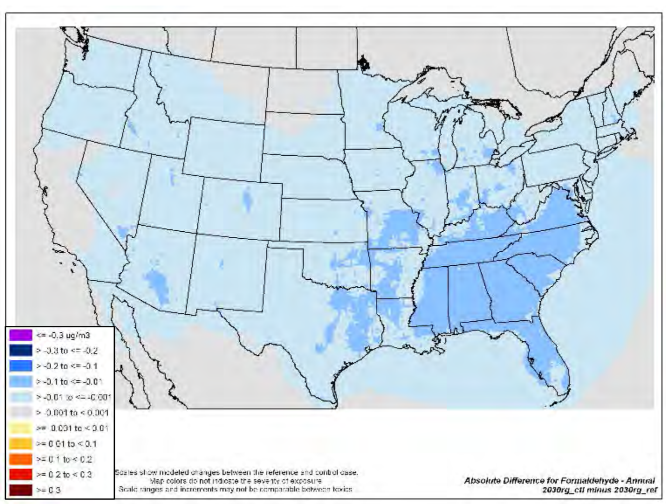

Figure 15. Change in absolute concentrations of annual average formaldehyde in 2030, with and without Tier 3 standards